A Third CITATION

FOR THE INSTRUMENT LEADER

. . . FOR MERITORIOUS WAR PRODUCTION

This third citation for meritorious war production . . climaxing a long record of war service . . . is a source of justifiable pride to the men and women of WESTON.

The record began back in the earliest days of our defense period, when a large segment of WESTONS' capacity was assigned to the production of instruments vital to military needs. Thus, when we finally were forced into this world struggle, WESTON was ready for *full-scale war production.*

This new star which adorns our "E" pennant marks the *third* time WESTON has been *first* in this highly specialized field to receive each successive war citation. Weston Electrical Instrument Corporation, Newark 5, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 55 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

TK1
E5
v.121:2

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

April 1, 1944 — Vol. 121, No. 14

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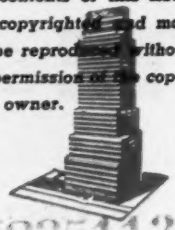

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Please change my address on Electrical World

From .. ..

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To .....

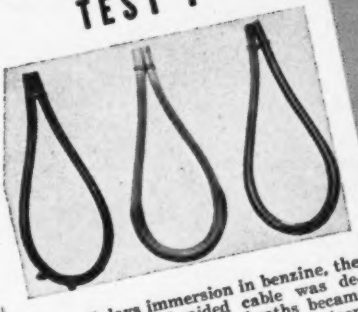
.....

Signed ....

OKOLITE-OKOPRENE CABLES

HAVE HIGH RESISTANCE TO OIL, ACIDS AND CORROSIVES

TEST 1



After 7 days immersion in benzine, the insulation on braided cable was destroyed (left), rubber sheaths became soft, increased 51.7% in diameter (center), while Okoprene stayed in excellent condition and increased only 22.1% in diameter.

TEST 2

In sulphuric acid battery electrolyte of specific gravity 1.300 at a temperature of 160 deg. F., the Okoprene sheath was in good condition after 21 months immersion.

Okolite-Okoprene cables are designed to resist oil, acids and other corrosive chemicals. The Okoprene sheath also provides added electrical protection.

Moisture-resistant, tough and long-lived, Okolite-Okoprene cables require no additional covering. They are self-contained. Yet with all their advantages they cost no more than high grade braided cables. Millions of feet are giving highly satisfactory service in refineries, chemical plants, mines, railroads and other electrical applications where other cables do not last.

GREATER RESISTANCE TO OIL — When exposed to the solvent action of commonly prevalent petroleum products, Okoprene sheaths protect the wire insulation from swelling and softening. Unlike rubber, Okoprene sheaths retain their full mechanical strength after such exposure.

NOT ATTACKED BY CORROSIVE CHEMICALS — The Okoprene covering has excellent resistance to most acids, alkalies and other corrosive chemicals.

Insulated with Okolite oil-base insulation and protected by a sheath of Okoprene, moisture-resisting Okolite-Okoprene cables (U. S. Patent 2,312,058) may be installed in ducts, buried directly in the earth or exposed to the elements without additional protection. *Simple to handle, splice and terminate, they are available in all standard sizes and many colors for service up to 5000 volts. For further details, send for Bulletin OK-2009C.* The Okonite Company, Passaic, New Jersey.

LOOK FOR THE SINGLE RIDGE ON OKOLITE-OKOPRENE

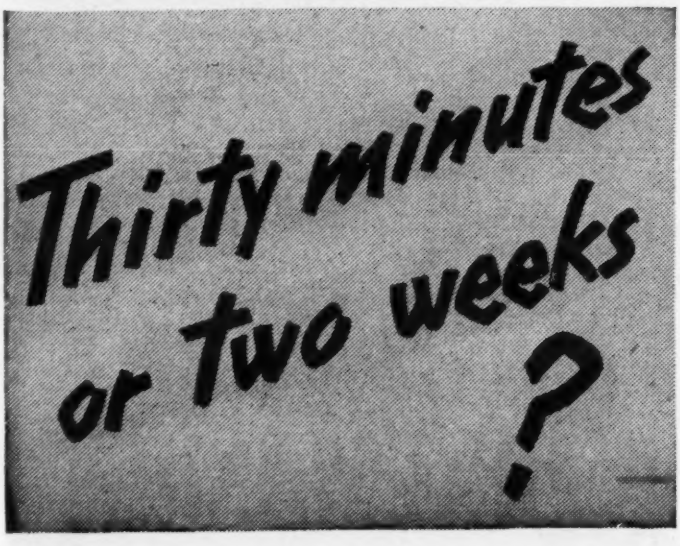
OKONITE INSULATED WIRES & CABLES

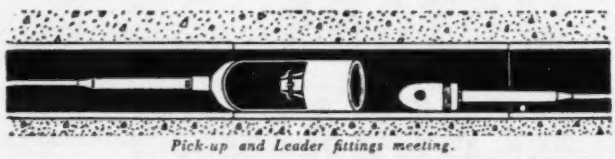
UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.



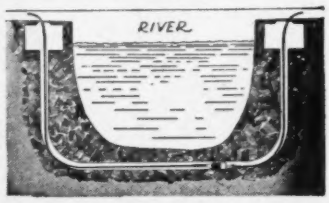


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

FOR REASONS OF SECURITY we cannot tell you how many of these tough fighters in Uncle Sam's submarine navy have been and are being electrically powered by Elliott. But there are far too many for the peace of mind of Emperor Hirohito and his staff, viewing with trepidation his fast-shrinking maritime and naval resources.

For years now, U. S. naval officers and inspectors have been at home in the Elliott plants, working with our engineers, inspecting step by step Elliott production, checking on finished equipment. Many of the results of this close cooperation have been expressed in periscope views of a highly pleasing nature, and in awards to commanders and crews of U. S. subs.

Elliott motors, generators and related equipment, successfully passing the test of war, may be expected to pass any possible test of industry. If you have a motor or generator job which calls for the utmost in service, talk it over with the Elliott engineers.

MOTORS *and* **GENERATORS**

by **Elliott**

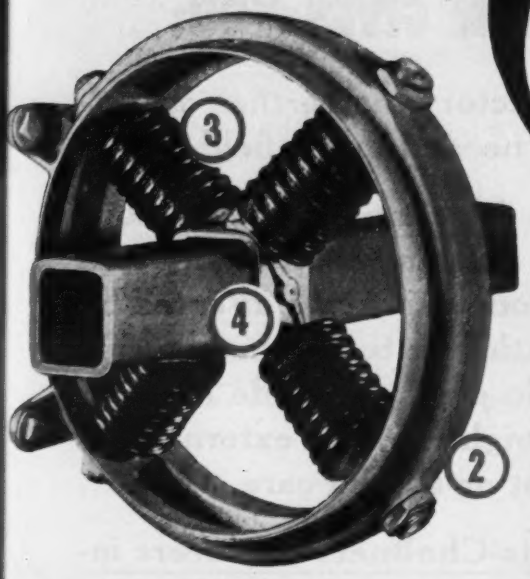
ELLIOTT COMPANY
Electric Power Dept., **RIDGWAY, PA.**
MARINE DEPT., 225 BROADWAY, NEW YORK 7, N. Y.
DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

L-748

CHECK the FACTS

1. Sealed, dust proof, individual bus housing provides phase isolation and prevents interphase short circuit. Removable covers in unit sections simplify routine inspection.
2. Supporting ring frames equalize all stresses. Can be mounted in any position.
3. With interchangeable insulator units always in compression, porcelain is used to its best advantage.
4. The same conductor support collar is used for both fixed and expansion slide position. Conductor can be square, round, channel or bar, insulated or bare.



Suitable for any voltage or current

R&IE ISOLATED PHASE BUS

The Check List

CONDUCTOR SUPPORTS CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

AIR BREAK SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

ALL RECTIFIERS ARE NOT ALIKE!

ONLY ALLIS-CHALMERS EXCITRON GIVES YOU:

☛ "Continuous Excitation": No ignition impulses to be synchronized with main anode voltage. Tubes *do not* require re-ignition on each positive half-cycle.

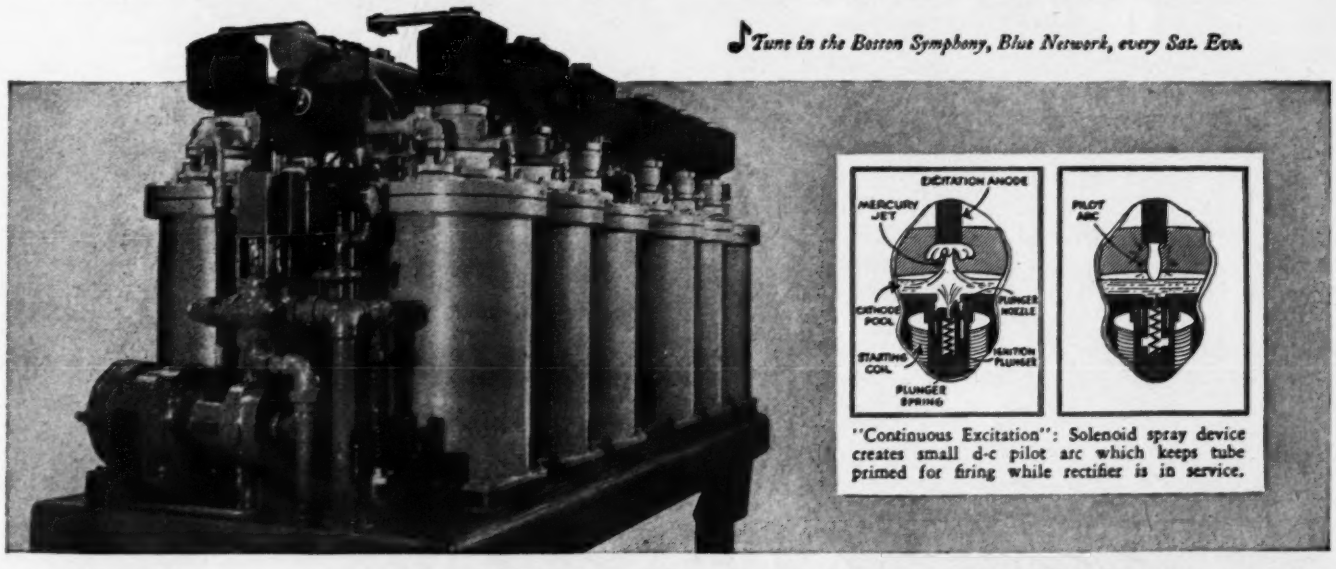
☛ Stability of excitation: Not affected by average single phase dips in a-c system voltage—nor system voltage wave shape. Excitron uses direct current from a 3-phase source for excitation of tube.

☛ Simple excitation circuit: No "tuning" to maintain proper wave shape. Once adjusted and tested at the factory, *no further adjustment* is needed in the field.

☛ Fixed excitation anode: Above and not touching hot mercury supply. Anode *cannot be affected* by any coating or turbulence on surface. No critical anode location which might require external adjustment or special care.

☛ Allis-Chalmers engineers introduced mercury arc rectifiers to U. S. industry. Consider Excitron for all power conversion. Allis-Chalmers, Milwaukee 1, Wis. A 1716

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*



"Continuous Excitation": Solenoid spray device creates small d-c pilot arc which keeps tube primed for firing while rectifier is in service.

ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS

(RUGGED / PORCELAIN) + (IMMERSION / IN OIL) + (AIR TIGHT / PROTECTION) = THE MOST TROUBLE-FREE / BUSHING DIELECTRIC

Where insulation is exposed to all kinds of hardships; moisture, freezing contamination, over-load, lightning--that insulation is porcelain. In millions of places it has proved itself capable of rendering the best and longest service with the least trouble or attention...Give this same insulation the protection of an air-tight chamber along with emersion in oil and it becomes an almost perfect bushing dielectric. Time has no effect upon it. Accidental discharges leave no conductive scar that can lead to later break-down. It is not sensitive to heat. Nor is it dependent upon exact condition of the oil for satisfactory results...When so rugged an insulation as porcelain is given the elaborate protection present in bushing design, safety factors and all around performance are pyramided...This is why O-B bushings use porcelain dielectric. It's also why these bushings have truly established standards of performance new to this class of apparatus. It's a reason why, when once used, O-B bushings are repeatedly specified for additional equipment. On your next bushing requirements, call for O-B and get the only bushing insulated inside and out with the most rugged of all dielectrics--porcelain!

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

247141

Invest in Finer and longer Life

★ Contacts of Allis-Chalmers Load Ratio Control units are heavy-duty, long-life . . . made of exclusive, non-burning Elkonite RS-1045.

★ These special Allis-Chalmers contacts practically eliminate wear and unexpected "outage", cut routine servicing.

★ Circuit breakers interrupt current between tap changes — giving shockless contact movement, reducing wear.

★ To minimize inspection time on large units, motor-operated tank hoist raises and lowers circuit breaker housing.

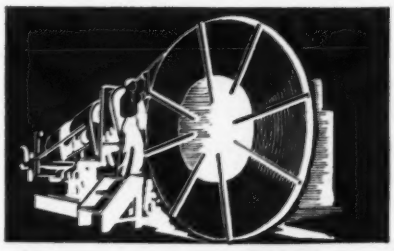
★ "Feather-Touch" Control is available for automatic regulation. Its exclusive voltage integrator assures best overall voltage characteristics.

★ Entire unit is ruggedly built for the years . . . precision-machined for top efficiency.

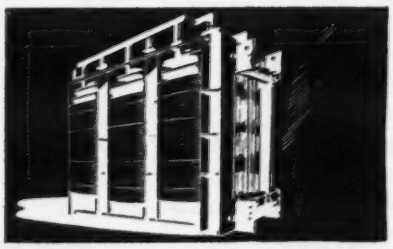
★ Over 8,000,000 kva of U. S. power is regulated by Allis-Chalmers Load Ratio Control. A-C pioneering in this field pays off to the buyer of every unit.

A 1687

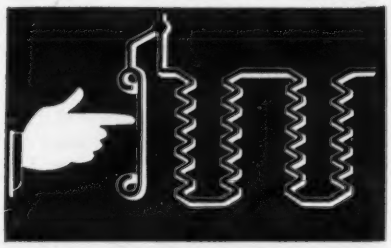
Wise Buy: ALLIS-CHALMERS POWER



CIRCULAR COIL is the ideal design electrically — is strongest mechanically. Wound with uniform tension. Has heavy turn-to-turn insulation, brazed connections.



SHELL TYPE CONSTRUCTION permits solid insulation between coils without impeding oil circulation. Results: increased cooling, longer life, lower maintenance.



ELECTROSTATIC PLATE absorbs shock of high impulse voltage, distributes stress evenly . . . thus safeguards transformer life, reduces possibility of unexpected breakdown.

Voltage Control

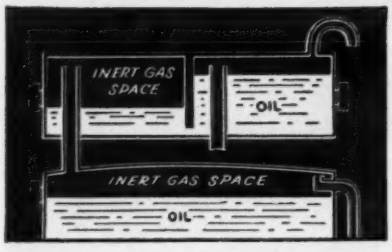
AS A LEADER in the field of precision-machined electrical apparatus, Allis-Chalmers offers advanced, time-proven load ratio control equipment.

Exclusive features such as "Feather-Touch" control and Elkonite RS-1045 contacts contribute to longer operating life — greater dependability.

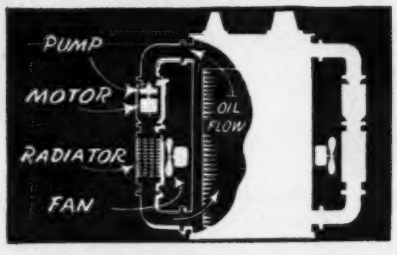
Get the complete story from our nearby district office. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

WE WORK FOR VICTORY WE PLAN FOR PEACE

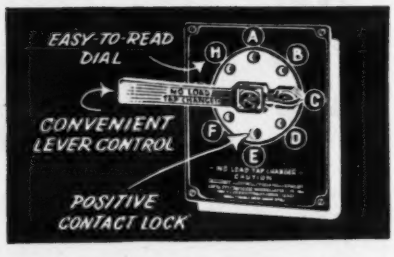
TRANSFORMERS *with Load Ratio Control*



OIL-SEALED INERT GAS EQUIPMENT provides low pressure cushion over insulating oil to allow for expansion. It's simple, foolproof . . . has no moving parts, no delicate valves.

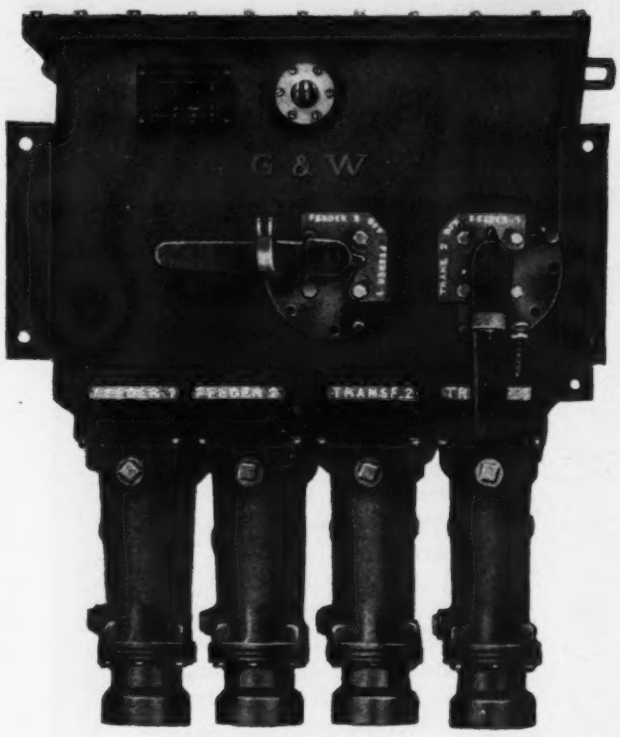


ELECTRO-COOLER for economical, practical forced-oil cooling. Steps up load capacity by accelerating oil-cooling process. A self contained unit requiring minimum maintenance.



NO-LOAD TAP CHANGER operates from side of tank, away from high voltage lines—is convenient and safe. Operating mechanism is simple, sturdy; contacts are heavy-duty.

"A remarkable development in compactness and simplicity"

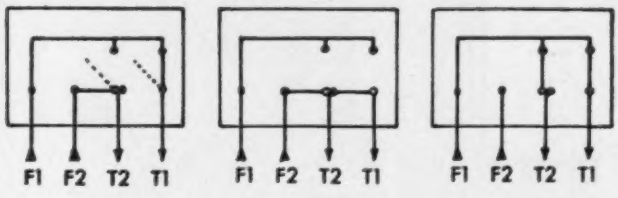


G & W TYPE "RAK" SUBWAY OIL SWITCHES

provide for

Connecting 2 loads independently to 2 feeds or connecting both loads to either feed circuit.

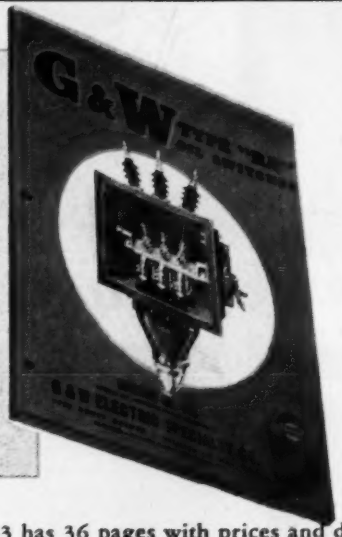
With only 2 sets of Links



Fully metal enclosed water-tight construction with unit sealed cable heads. Links are operated by external levers.

Standard ratings:
3 pole, 7500 volts, 400 amperes.
3 pole, 15000 volts, 400 amperes.

SEND FOR NEW BUL. No. 743 →



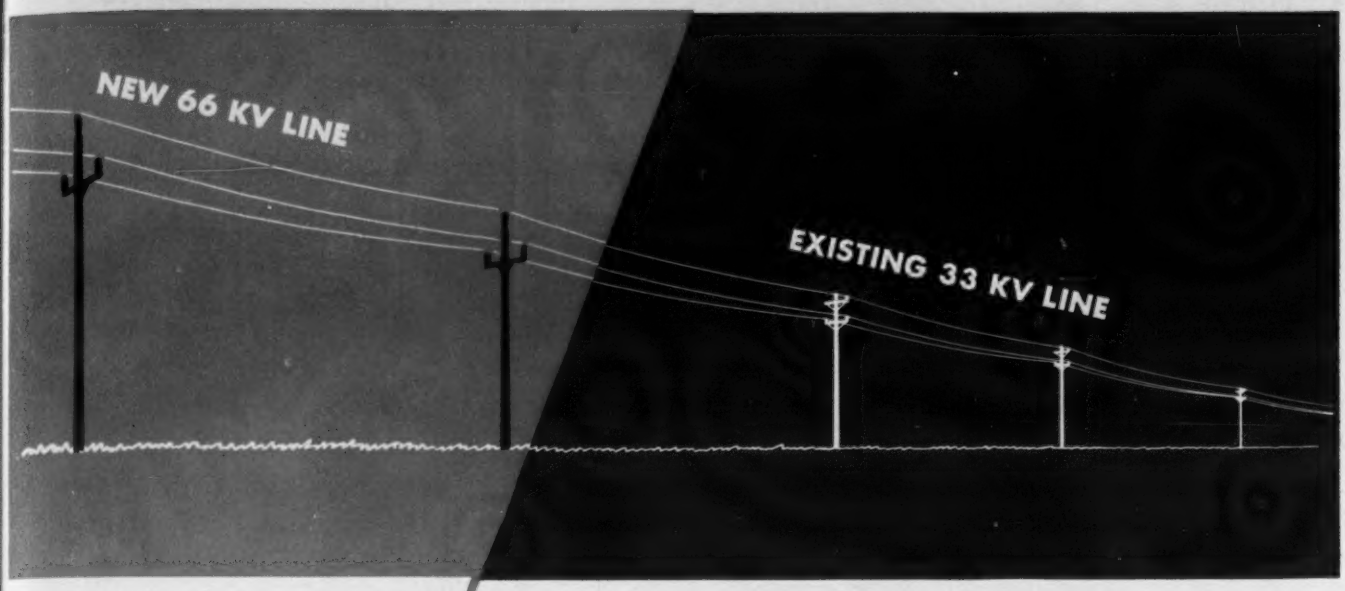
New Bul. No. 743 has 36 pages with prices and detailed dimensions of various forms of G & W TYPE "RA" oil switches and transformer disconnects.

INSERT BULLETIN IN YOUR G & W CATALOG BINDER →

G & W CATALOG INCLUDES BULLETINS ON POTHEADS, BOXES, OIL FUSE CUTOUTS AND OIL SWITCHES & DISCONNECTS

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.

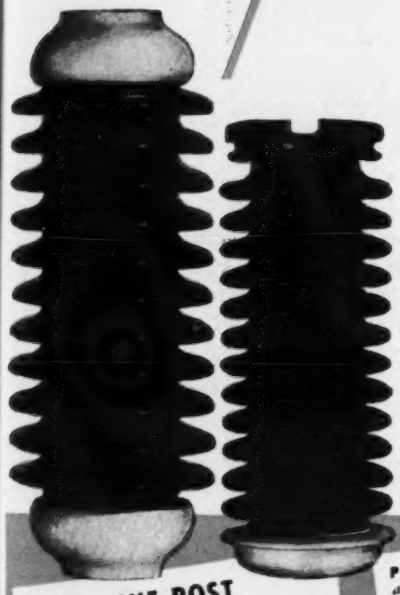
IN CANADA—POWERLITE DEVICES, LTD., TORONTO



LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system . . . . and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new crossarms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Here is another in the G-E series of air conditioning advertisements
Appearing in hotel, restaurant, store and theater publications, this series is designed to stimulate the interest of management executives in post-war installations of air conditioning—a promising field for future growth, both for G-E and for public utilities.

"Since this hotel put in Air Conditioning they always spend their vacation here."

These days, people know enough to come in out of the heat . . . to a place that's air conditioned.

Most everyone now knows that it's a lot easier to sleep in an air conditioned room on a sultry summer night . . . and that food tastes better in a comfortable air conditioned restaurant.

But there are other advantages of air conditioning one may not think about. It affects hotel employees, too . . . they give better service. Food stays fresher . . . and rooms and linens stay clean longer.

Out of General Electric's war work is coming a finer air conditioning . . . compact, flexible . . . with precise control of both temperature and humidity. Now needed by war industry . . . this improved equipment will become available to all after the war.

Interested? Write: *General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 4194, Bloomfield, New Jersey.*

☆ BUY WAR BONDS ☆

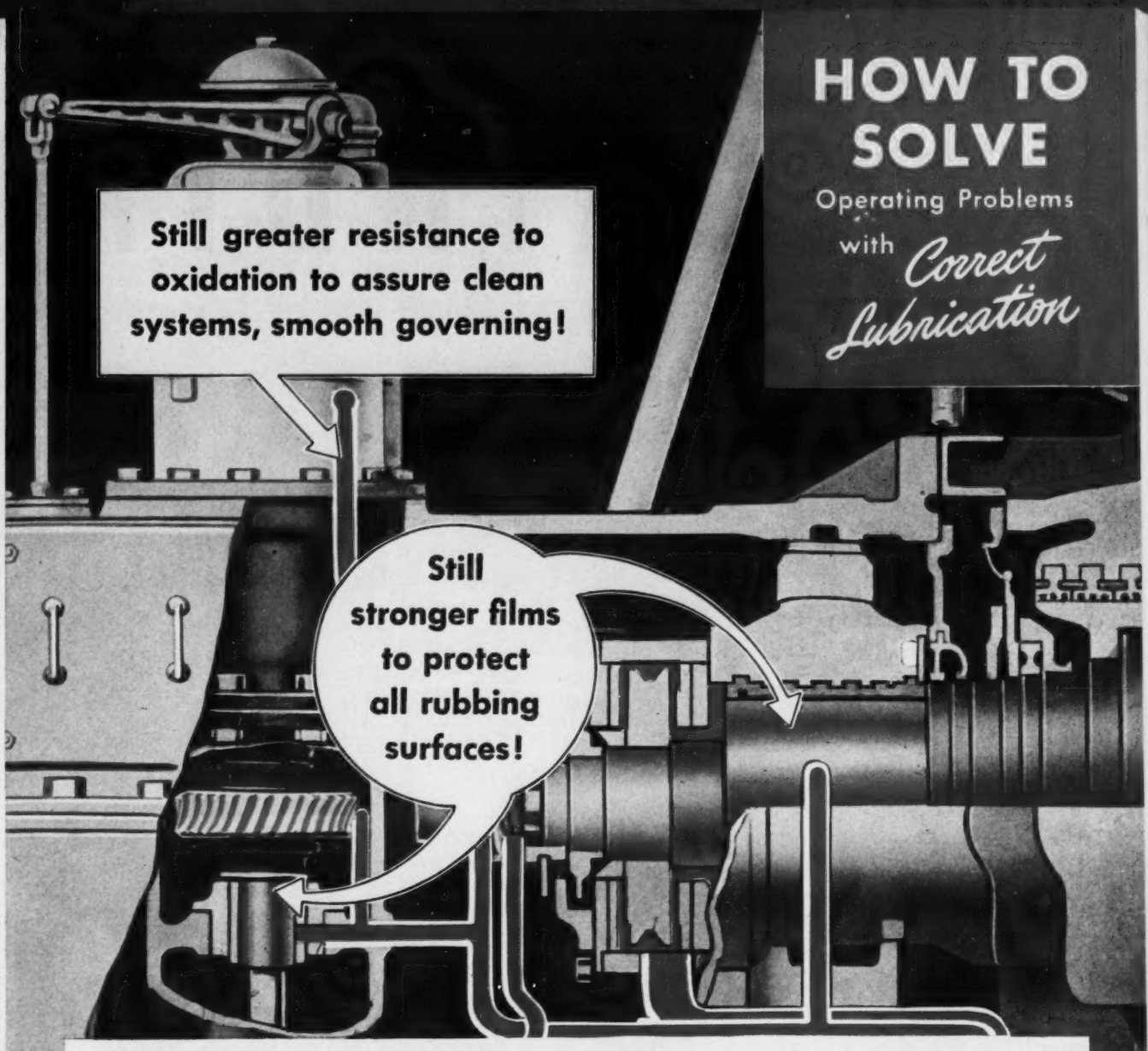
Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays 10 P. M., EWT, NBC . . . "THE WORLD TODAY" News, Every Weekday, 6:45 P. M., EWT, CBS

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION


Still greater resistance to oxidation to assure clean systems, smooth governing!
Still stronger films to protect all rubbing surfaces!

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Meet severe turbine operation with this *Extra Protection!*

UNDER today's severe operating conditions, steam turbines have become more dependent than ever upon Correct Lubrication.

The oil, serving as both a hydraulic medium for the governing system and a lubricant for swiftly moving parts, faces much higher temperatures and pressures. Yet it must stand up over years of service.

Gargoyle D.T.E. Oils for Turbines have been improved to meet the most severe conditions — to provide extra margins of protection against them. They combine greater resistance to oxidation and rust with stronger films — to set even higher standards of performance than the famous D.T.E. Oils of the past.

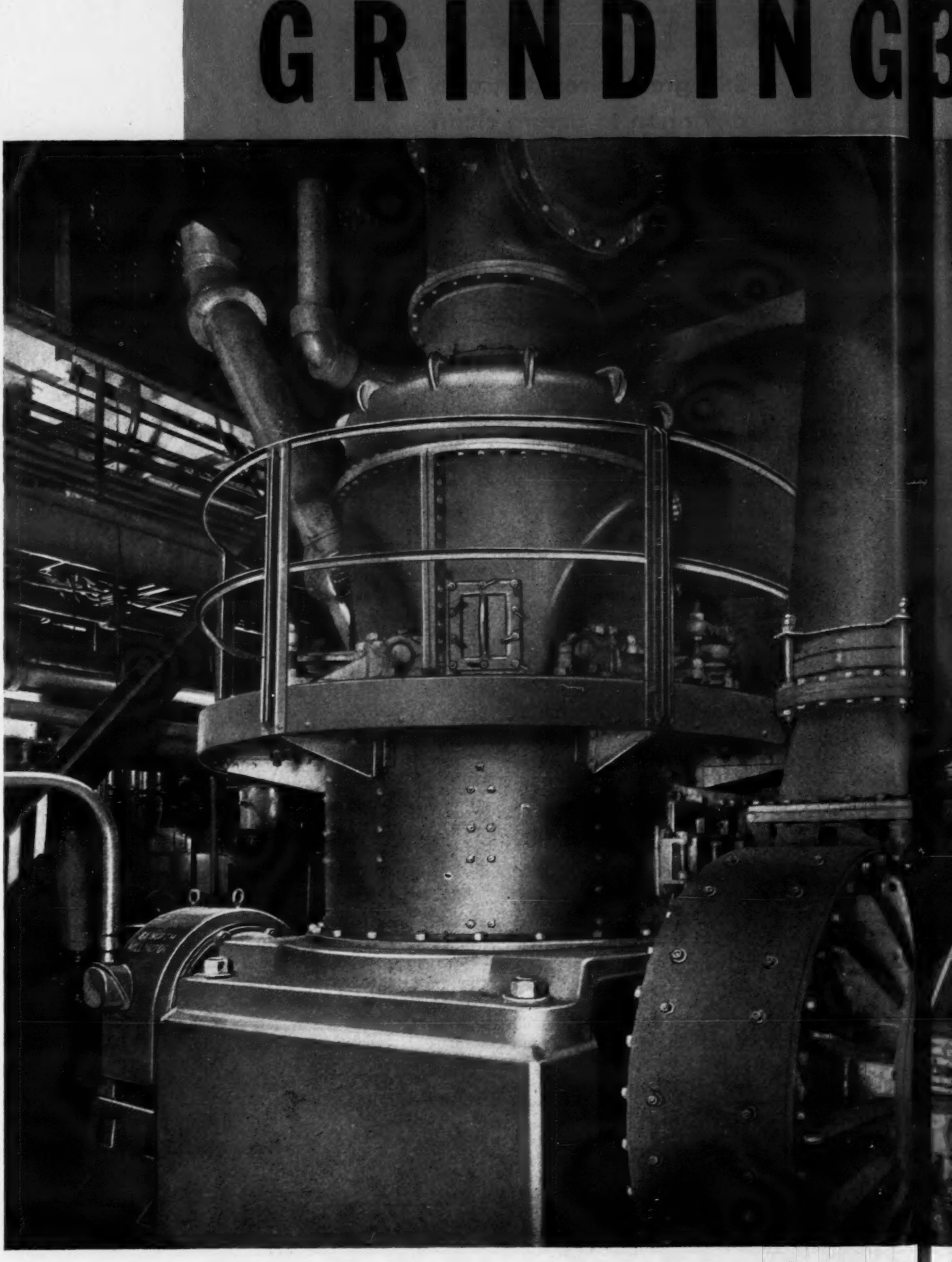
No wonder over 50 percent of all major-size steam turbines in the United States are lubricated by Gargoyle D.T.E. Oils.

SOCONY-VACUUM OIL CO., INC., Standard Oil of N.Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California.

GARGOYLE Lubricants

GARGOYLE D.T.E. OILS

GRINDING



35,000,000 TONS OF COAL A YEAR!

IMAGINE 35,000,000 tons of coal — or picture 700,000 loaded coal cars stretching from New York to Cairo. Such is the aggregate of the amount of coal we can assume is being pulverized in a single year by all the C-E Raymond Bowl Mills purchased to date. Obviously the figure is an approximation, but a conservative one, since it is based on an average of 5,400 operating hours for each mill — about 60% of the total number of available hours in one year.

This grinding capacity serves to show the remarkable acceptance accorded the C-E Raymond Bowl Mill for pulverized coal fired installations. It is the more remarkable when you remember that the C-E Raymond Bowl Mill was placed on the market only 9 years ago. This is a strikingly brief period of time for a piece of major industrial equipment to win such widespread endorsement. But it's a likely result of the superiority demonstrated by the C-E Raymond Bowl Mill in such desirable qualities as dependability, noiselessness, low power consumption and low maintenance expense. A-784

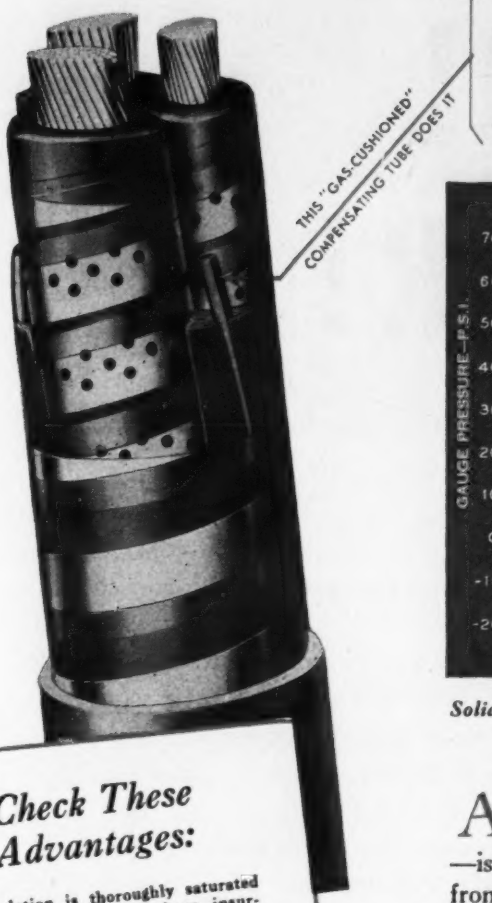
COMBUSTION ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

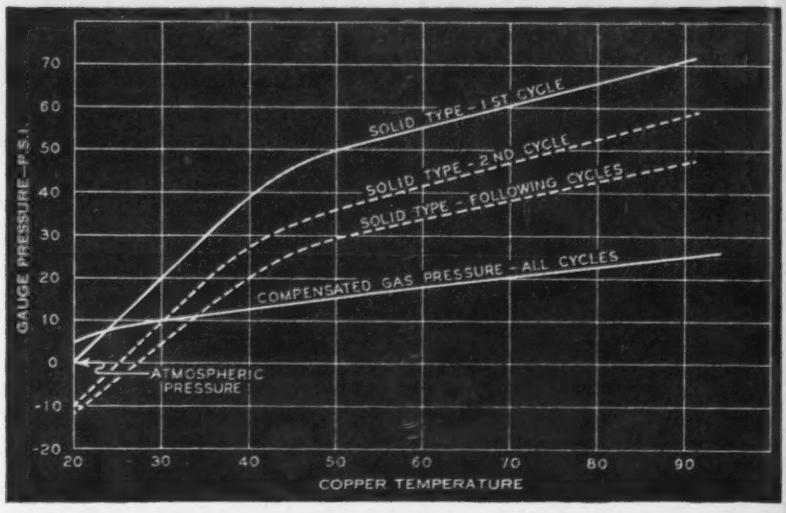
Canadian Associates: COMBUSTION ENGINEERING CORPORATION LIMITED • Montreal • Toronto • Winnipeg • Vancouver

THIS NEW PAPER INSULATED POWER CABLE

Type PC Pressure-Compensated Cable



Stabilizes operating pressures within fixed limits



Solid cable versus Type PC. A comparison of internal pressures under load.

Check These Advantages:

1. Insulation is thoroughly saturated with compound at all times, insuring maintenance of low thermal resistivity.
2. Internal pressure is stabilized within prescribed limits.
3. Controlled sheath stresses—no repeated expansion and contraction, no fatigue or circumferential splitting of lead.
4. Internal pressure along cable line is uniform, not variable from joint to joint.
5. Avoids necessity of continuous sheath supervision by eliminating high internal stresses. Provides a means, where desired, of detecting major sheath damage.
6. Interchangeability. Cable can be spliced to existing solid type cable without difficulty.
7. Increased current carrying capacity —where limits are based on allowable sheath stress. Type PC Cable controls these stresses.
8. Possibility of operation under higher voltage gradients since ionization and internal vacuum are eliminated.
9. Reduced overall transmission cost per KVA mile.

A PRESSURE-compensating gas cushion—provided by one or more small perforated tubes included in the impregnated fillers —is the unique but simple method which prevents the wide swings from pressure to vacuum that are encountered in ordinary solid type cables.

In Type PC Cable, the positive pressure-operating characteristics of oil-filled or gas-filled cables are obtained with no radical departure from the basic construction of "solid" cable. Moreover, neither the original cost of Type PC Cable nor the expense of installation and supervision are substantially higher than that of "solid" cable.

Type PC Pressure-Compensated Cables that have been under laboratory tests for the past eighteen months exhibit a positive control of internal pressure. The fact that they operate under a slight positive pressure at all times has resulted in life tests under load and voltage cycles in excess of 500 volts per mil equivalent one hour life.

We have just issued a new bulletin outlining the entire story. Send for your copy.

AMERICAN STEEL & WIRE COMPANY

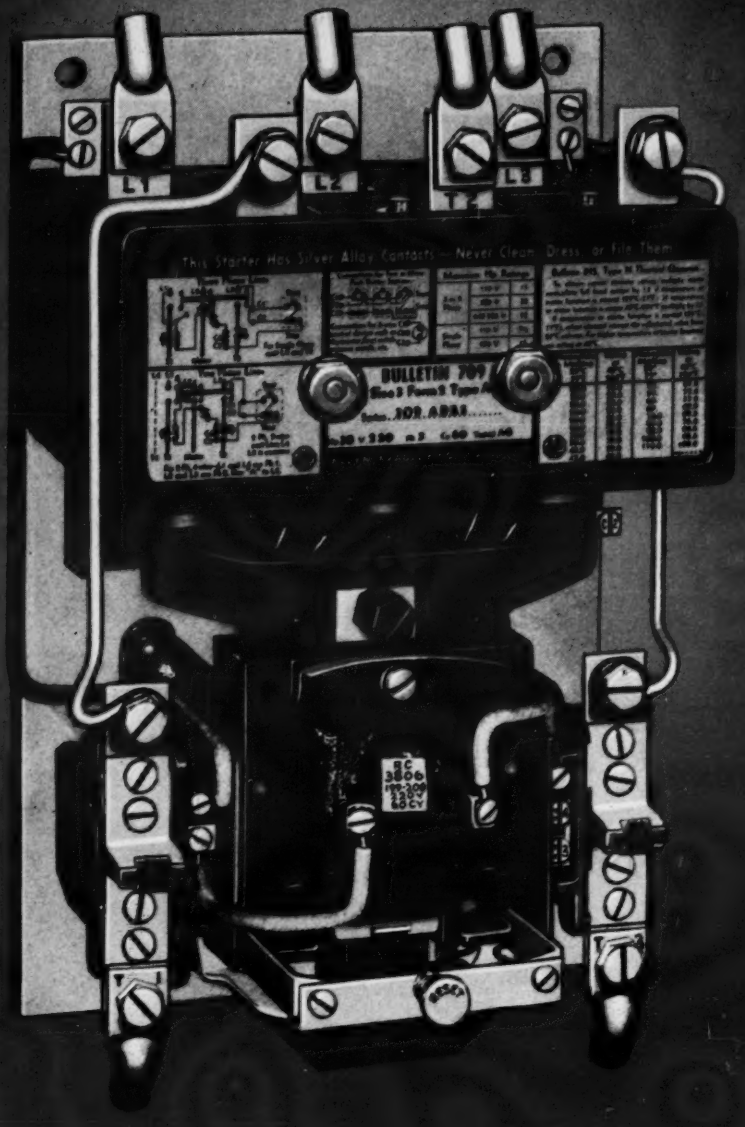
Cleveland, Chicago and New York

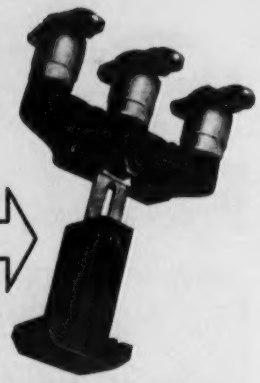
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

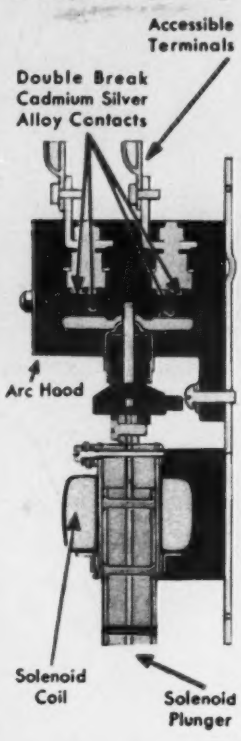
Look how SIMPLE

THERE'S NEVER ANY CONTACT MAINTENANCE



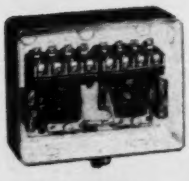


Allen-Bradley Double Break, Silver Alloy Contacts need no attention—no dressing, cleaning, or filing.



Arc hood enclosing the contacts permits unusually compact construction with plenty of wiring space at top, bottom, and sides. Completely removable cover, plenty of knockouts in sides and back, and white interior make installation easy.

Automatic


Reversing

Multispeed

Combination

Allen-Bradley solenoid starters never require any contact maintenance because any oxide which may form in the switching operation is a good conductor. There are no pins, pivots, bearings, hinges, or flexible jumpers to gum up, stick, or corrode. A-B starters are good for millions of trouble-free operations. You install 'em . . . then forget 'em. Send for Bulletin 709.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Motor Starter Enclosures...
For Every Type of Service

You can find the correct type of enclosure in the Allen-Bradley starter line for any application.

The general-purpose enclosure, specified for most installations, is sheet steel . . . "bonderized" . . . to provide a rust-resisting undercoat for the baked enamel finish. The adhesion and durability of the enamel surface is tremendously increased. Infra-red lamp ovens are used for hardening the enamel top coat.

Enclosures for special applications are made of cast iron or sheet steel, depending upon the hazard encountered. Live rubber gaskets, machined fit between cover and base, wide machined flanges, or bolted covers provide full protection under various service conditions.

The two models for wall or pedestal mounting were designed specially for machine tool applications. They help improve the appearance of machine tools by making streamlining possible.

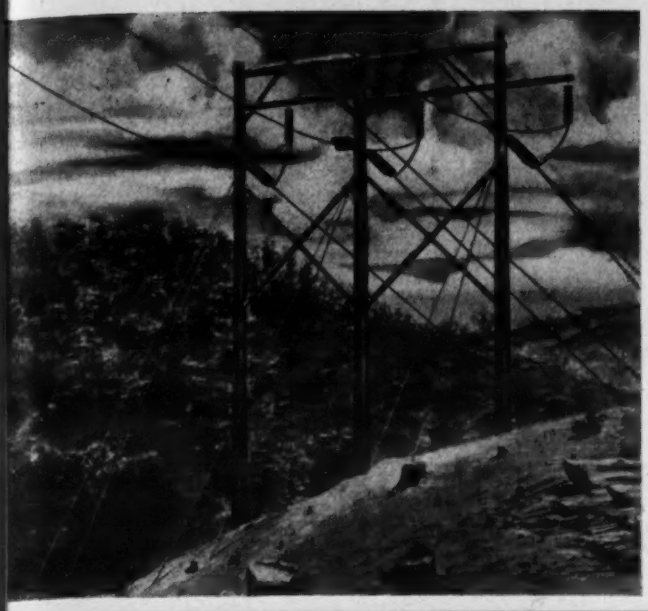
Contactors, relays, pilot controls, etc., are available in the same safe, practical, and carefully engineered enclosures.

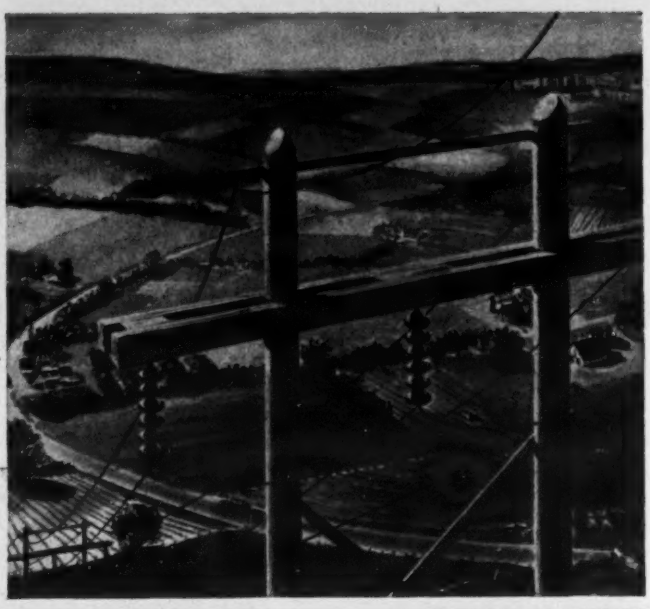
ALLEN-BRADLEY COMPANY
1316 S. Second St.
Milwaukee 4, Wis.

ALLEN-BRADLEY

SOLENOID MOTOR

QUALITY





Regardless of DISTANCE or TERRAIN

Hoosier engineers and trained men are available to efficiently and economically supplement your own organization on any erection or maintenance job. If you are having difficulty meeting today's urgent demand for power . . . if you have a problem of time or manpower . . . Hoosier service can help you meet it.

HOOSIER ENGINEERING CO.

ERECTION and MAINTENANCE OF TRANSMISSION LINES

NEW YORK **46 S. FIFTH ST., COLUMBUS, OHIO** CHICAGO

LIFE ON THE PLASTICS NEWSFRONT

NEW MELMAC MANUAL SENT UPON REQUEST

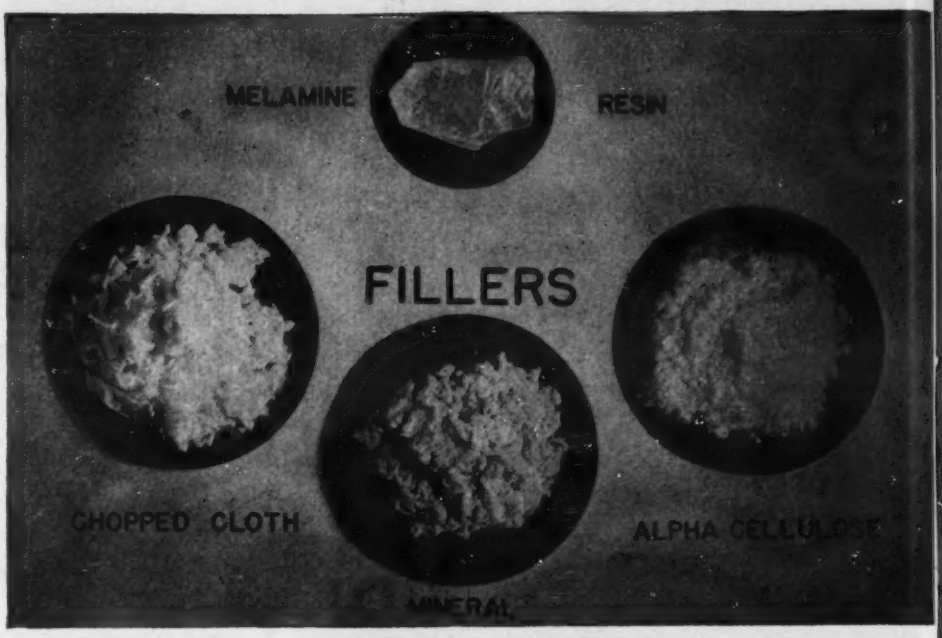
"MELMAC Molding Compounds," a new illustrated manual, complete with tables and charts, is available to designers, engineers, and executives interested in the fabrication and use of plastics. It contains complete information and technical data on molding methods, applications, design instructions, and property charts for MELMAC molding materials currently available.

(*Right*) **CHOICE OF FILLERS** for Cyanamid's melamine resin, MELMAC*, is determined by the properties desired in the finished product.

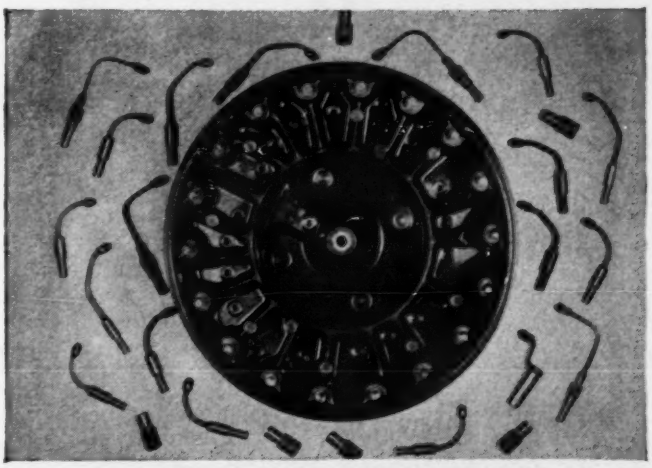
When the basic uncured resin is combined with chopped cotton cloth the molded material has high flexural strength, good shock resistance and low water absorption.

With alpha cellulose pulp fiber it has low moisture absorption, color, resistance to staining and abrasion.

Mineral-filled MELMAC is designed for applications where heat and arc resistance and high dielectric strength are of primary importance.



(*Below*) **TRANSFER MOLDED WITH 25 INSERTS,** this MELMAC distributor housing for an 18-cylinder radial aircraft engine is one of the most complicated plastic moldings in modern fighting planes. Good moldability, in addition to high dielectric strength and high arc resistance make mineral-filled MELMAC well adapted for such electrical uses. Effective April 1, the price of mineral-filled MELMAC was reduced.



(*Above*) **AN EXACT COLOR MATCH** can be obtained in plastics. Photo shows Color Control Laboratory where dyes and pigments used in Cyanamid plastics are checked and tested.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION · 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC · URAC · MELURAC · LAMINAC

Here's a

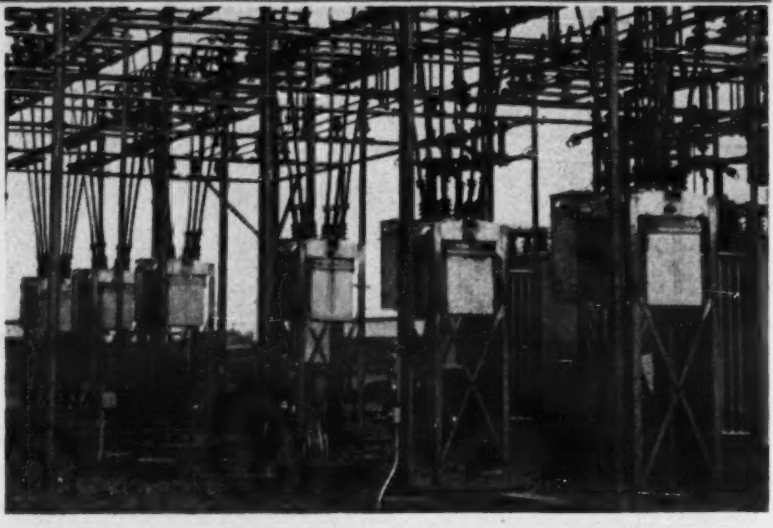
MORE RELIABLE BREAKER

7.5-kv or 15-kv

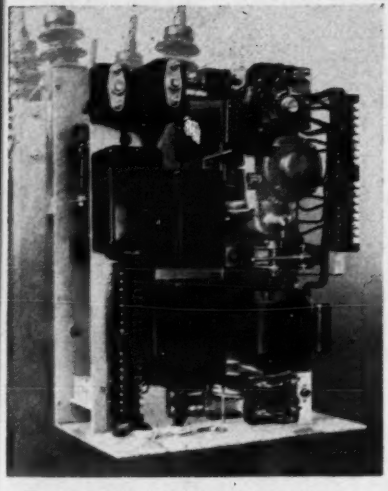
BECAUSE PACIFIC ELECTRIC

Gives you their famous

SPRING-OPERATED MOTOR MECHANISM



Type AKE-25, 7.5-kv., 400 and 600 amps; and Type AKE-40, 15-kv., 600 amps; 50,000-kva.



The Type MJ-1 Motor Mechanism is factory mounted on the breaker frame. Can be arranged for automatic reclosing by adding reclosing relay. Our Type DM-1 Control offers fast, reliable, automatic opening with manual closing.

Saves Critical Materials at Installation; Saves Installation Time, Shipped Assembled

You get positive protection from the most severe faults with this Pacific Electric Breaker equipped with the Spring-Operated Motor Mechanism.

The motor, operating on A.C. or D.C., as desired, automatically winds the strong operating spring which stores energy for fast opening and reclosing. You get operations on any number of transient faults.

Having no rectifiers, the operating-power circuit is simplified and you save critical materials. You save time at installation because the Motor Mechanism is factory mounted on the breaker frame, tested and shipped assembled.

At scores of installations this breaker's simple design, its sturdy construction, its fast arc extinguishment, assure reliability, safety and rock-bottom maintenance.

Ask for full details about Pacific Electric Breakers with the Spring-Operated Motor Mechanism. Then you will know that here is positive fault protection.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

A. A. Marrs
526 Dwight Bldg.
Kansas City, 6, Mo.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

R. Ackerman
318 Dooly Block
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Filbert & Fredericks
90 West St.
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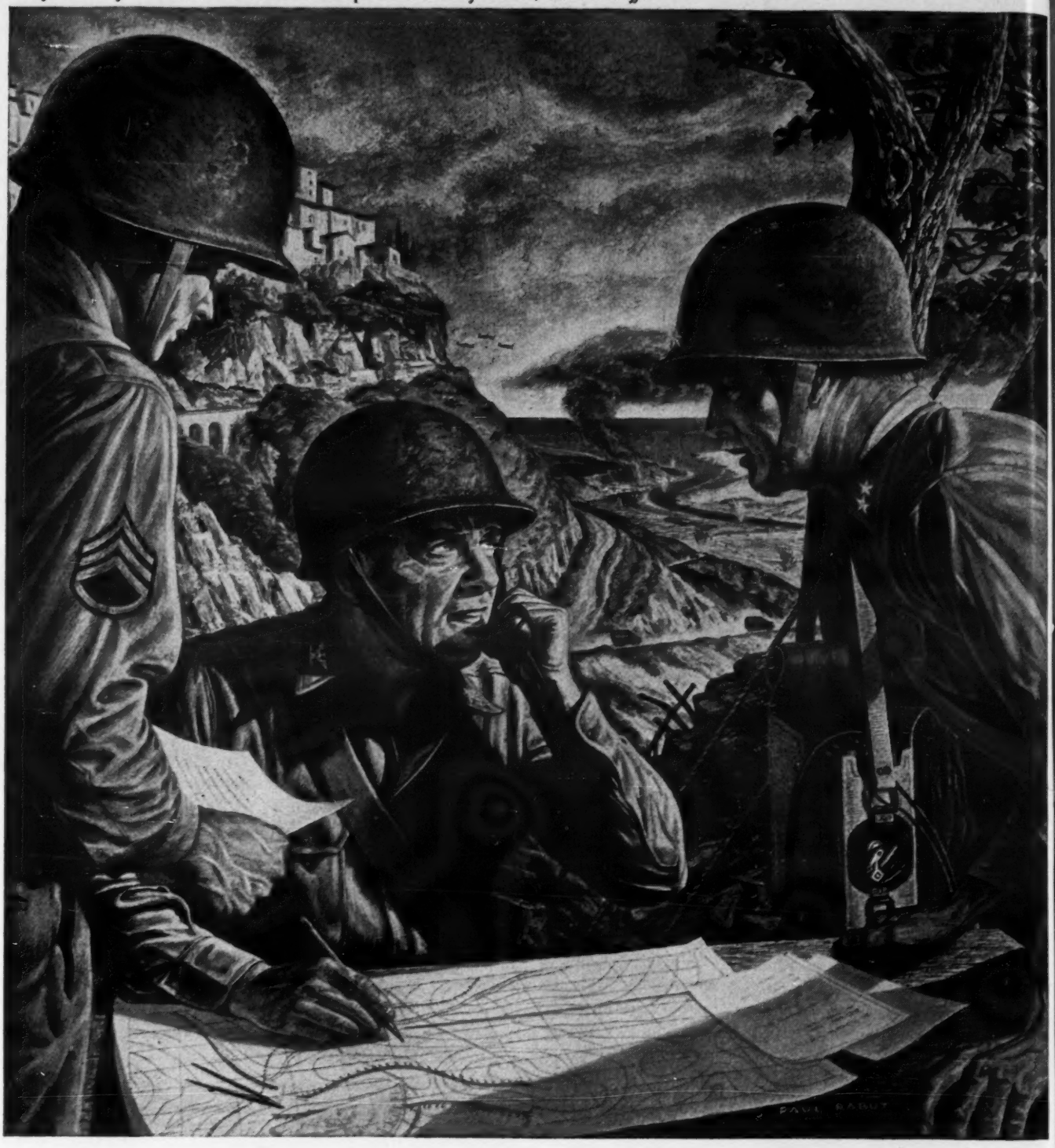
Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

Every branch of the Armed Services uses the telephone. No. 10 of a series, General Staff.



At Field Headquarters sits a staff officer—telephoning. In his hands, this familiar instrument, now a weapon of war, controls the striking power of our forces in the whole area of combat. Over it flow the orders that will drive back the enemy till the final order—"Cease Firing"—is flashed to every front.

Won t YOU help them lead our men to Victory?

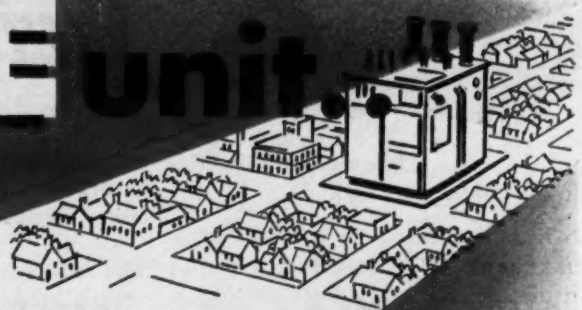
The ablest officers and the bravest men can win this war only with *your* full support. They must have weapons, food, supplies—more and *more* and MORE of them. Make sure they get them. Buy War Bonds, *more* War Bonds and STILL MORE!

75TH ANNIVERSARY

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

Move ONE unit...



QUICKLY... AT LOW COST TO NEW POSTWAR LOAD CENTERS

Westinghouse CSP Power Transformers contain in ONE UNIT:

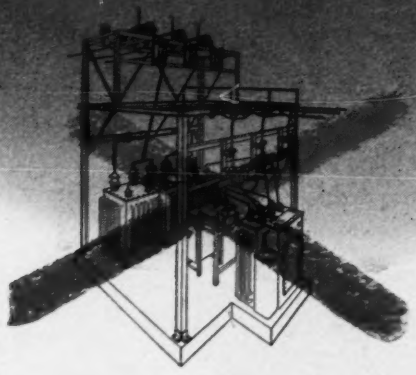
- transformer
- circuit breaker
- voltage regulator
- metering
- protection against —lightning
- protection against —overloads
- protection against —short circuits

. . . when it's a Westinghouse CSP (Completely Self Protecting) Power Transformer

Because the Westinghouse CSP Power Transformer can be moved as a unit, it has 100% salvage value when moved to a new load center. It can be moved by truck-trailer quickly—in a matter of hours. Compare this to the time required to disassemble and move the conventional single-feeder substation. The CSP Power Transformer saves both material and man-hours . . . will cut considerably your postwar system reconversion cost.

While new postwar load centers may be unpredictable, it will pay to have substations which can be moved in to fill the gaps. The Westinghouse CSP Power Transformer performs all the functions of a single-feeder conventional substation. It is Completely Self Protecting (CSP) against lightning, short circuits, and dangerous overloads.

For complete information, call your Westinghouse office, or write Westinghouse Electric & Manufacturing Co., Dept. 7-N, East Pittsburgh, Pa. J-70429



NOT THIS . . . piece-by-piece time-consuming removal and reassembly of the 43 major components of a conventional substation.

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PACKAGED POWER

Twice in a lifetime

He was just a little fellow a dozen years ago.

Too little to know — or care — that even as he slept, General Motors men in a distant laboratory were putting the finishing touches on a special new refrigerant later given the trade-mark, *"Freon."**

Much too little to understand that the real reason for developing this new compound was the safety of just such sleeping youngsters as himself.

That it was important because it provided the last link in perfect safety for home or hospital refrigeration, ending even the remote risk of toxic harm in the unlikely event of leaks in the cooling system.

He is grown now, and off fighting for his country on a South Pacific island.

He is old enough to know that one of his deadliest enemies there is the mosquito, carrier of malaria.

The interesting thing is that it is *"Freon"* that now comes to his aid. Twice in his lifetime, this one result of General Motors research is paying off in personal protection for him and his kind.

For when mixed with chemicals to kill mosquitoes, this compound makes a new and better kind of insect spray. Unlike heavier sprays that fall to the ground, it evaporates almost instantly, leaving the mosquito-killing compounds floating suspended in the air.

"Freon" was not developed as a war product. It came about because General Motors, seeking to provide more and better things for more people, never stopped trying to make better refrigerators for American households.

But because it was known and familiar, it was available when the war need appeared — just as it remains at hand for future peacetime developments.

The idea that built America — the idea that men accomplish most when they can win a just reward for doing great things — has served the country well in war.

And the same idea will keep on providing more and better things for more people in a world restored to lasting Peace.

*Trade-mark registered. "Freon" is made and sold by Kinetic Chemicals, Inc.

GENERAL MOTORS

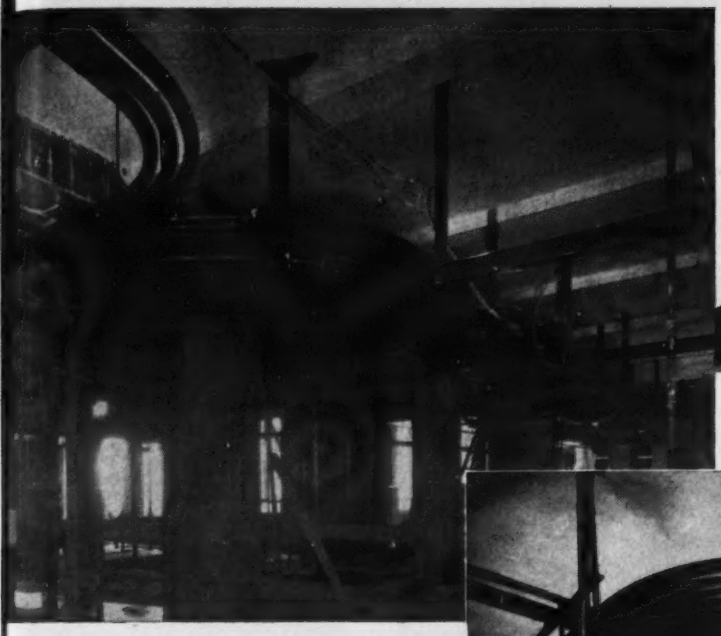
"VICTORY IS OUR BUSINESS"

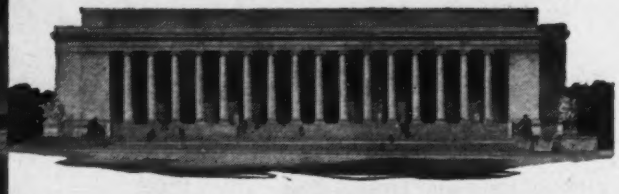
CHEVROLET • PONTIAC • OLDSMOBILE • BUICK
CADILLAC • BODY BY FISHER • FRIGIDAIRE
GMC TRUCK AND COACH

KEEP AMERICA STRONG
BUY WAR BONDS

How Central Rigid Steel Conduit was used in Mellon Institute

Built for Eternity





"There's Tested Strength in Every Length"

SPANG-CHALFANT

Division of The National Supply Company

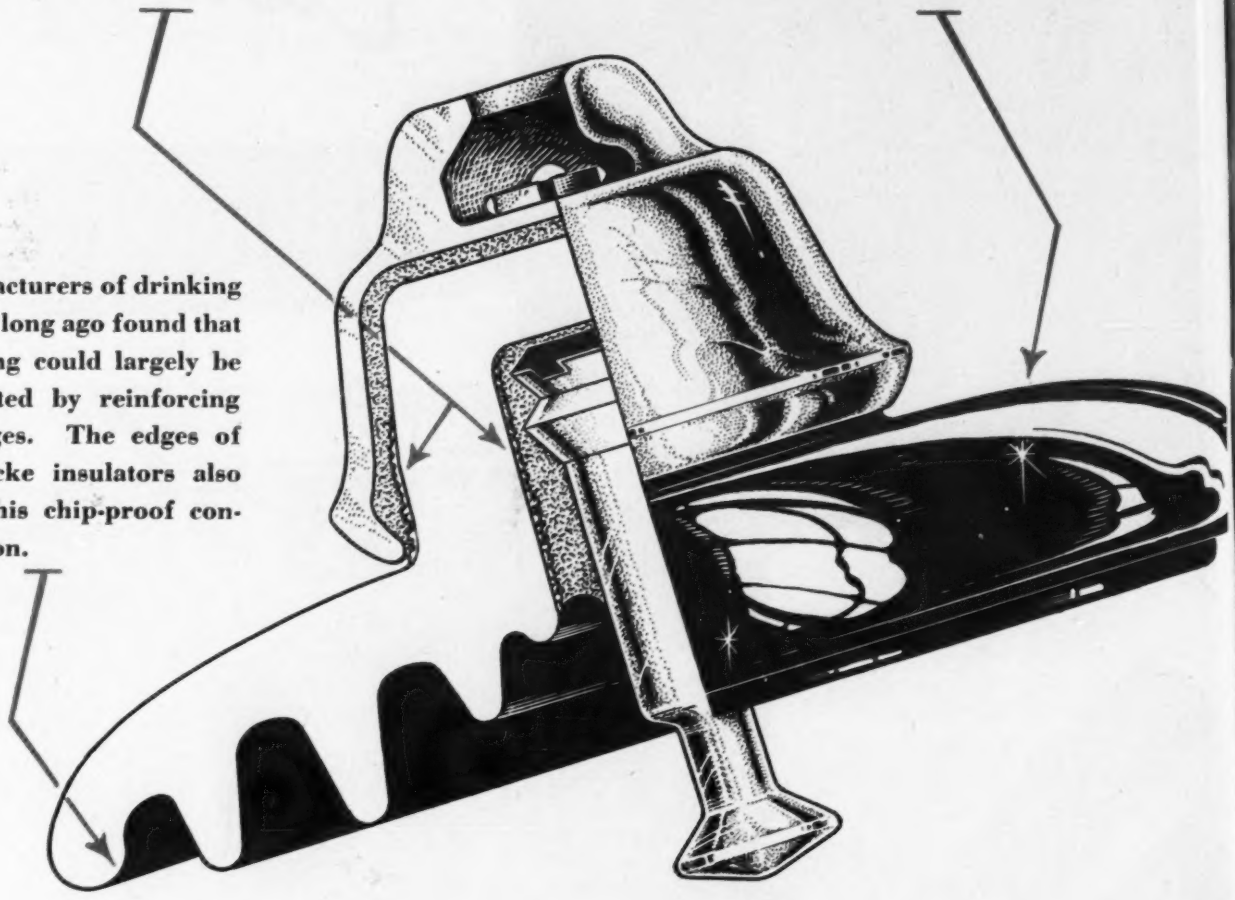
Executive Offices: Grant Building, Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

Greater Strength at

Even compression glazed insulators can be materially weakened when these surfaces are treated with ordinary "sands". Locke compression sand, on the contrary, makes these working zones the strongest part of the assembly.

The entire surface of every Locke insulator is in compression. Before the initial crack which causes breakage can occur the additional compression strength must be overcome.



Manufacturers of drinking glasses long ago found that chipping could largely be prevented by reinforcing all edges. The edges of all Locke insulators also have this chip-proof construction.

These Proved Benefits . . .

reduce upkeep—spread the initial costs of your insulators over more years—and enable your construction crews to handle installation and replacements faster and with greater safety.

ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

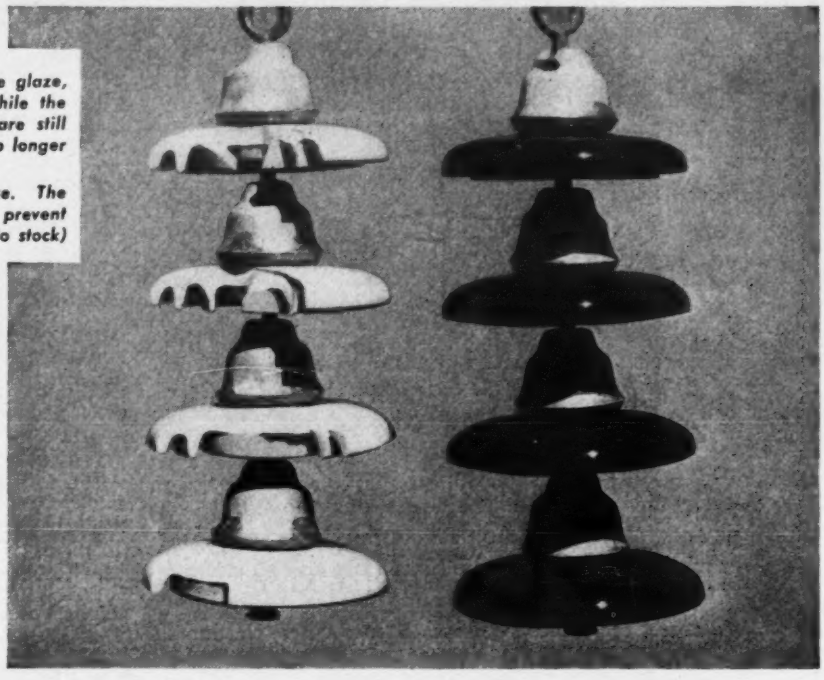
FIRST IN CLAYRAMICS

All Critical Points

Keeps Insulator Costs Down To A Minimum . . .

Thousands of operating engineers have seen the remarkable immunity to breakage of Locke insulators and thousands have proved it for themselves in service.

The increased factor of safety which these improvements assure you may easily be the margin between continuous operation and costly service interruptions.



These insulators, identical in every respect except the glaze, were subjected to the same mechanical impact. While the Locke Compression Glazed insulators on the right are still intact, those on the left, with ordinary glazing, are no longer fit for service.

(Color has no influence on the strength of the glaze. The weaker insulators were deliberately glazed white to prevent any possibility of such a unit accidentally getting into stock)

All Locke Insulators

are compression glazed and reinforced against chipping. In addition all Locke assembled insulators—or insulators furnished for assembly—are standard with Locke compression sand. These developments of the Locke Ceramic Laboratories are responsible for:

- **LONGER LIFE IN SERVICE**
- **MORE UNIFORM STRENGTH**
- **LOWER MAINTENANCE AND REPLACEMENT COSTS**
- **HIGH FACTORS OF SAFETY**
- **GREATER STABILITY**

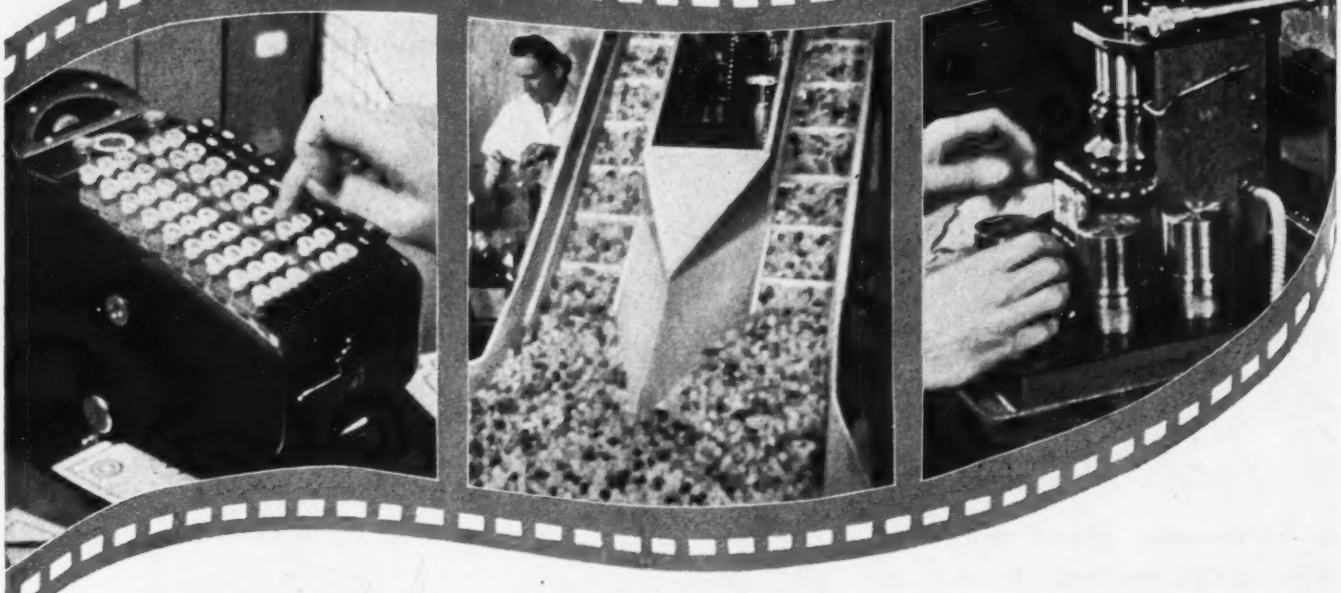
FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

CORPORATION BALTIMORE MARYLAND

FIRST IN CLAYRAMICS

"USES UNLIMITED"

A Dramatic Talking Motion Picture, in Color . . . Filled With Ideas for Production and Design Engineers

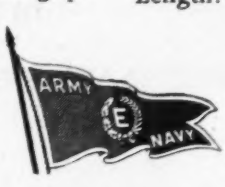


For ten years Micro Switch has been a leader in the development, throughout industry, of automatic electrical control. The war program drafted Micro Switches for use in almost every type of fighting and radiation equipment on land, on sea, and, most of all, in the air. It put them into production lines where the implements of war are being built.

Fast-moving action, interesting color, and the concise description of "Uses Unlimited" convey the grippingly romantic story of how Micro Switches are made. It shows the myriad ways this tiny switch serves to control everything from sensitive, precise instruments and office equipment, to ponderous shop machines.

This film is packed with examples of tried and proven applications of Micro Switches which will stimulate every engineer to new conceptions of uses for compact, lightweight, precise, long-lived, trouble-free, electrical controls.

"Uses Unlimited" is available to industrial groups, training classes, schools and colleges. Size: 16 mm. Length: thirty minutes. Write us for details.



Micro Switch Corporation, Freeport, Illinois • Branches: 43 East Ohio Street, Chicago (11) • 4900 Euclid Avenue, Cleveland (3) • 11 Park Place, New York City (7) • 1709 W. 8th St., Los Angeles (14) • Sales & Engineering Offices: Boston • Hartford

LET'S ALL BACK THE ATTACK
BUY EXTRA WAR BONDS

The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

© 1944

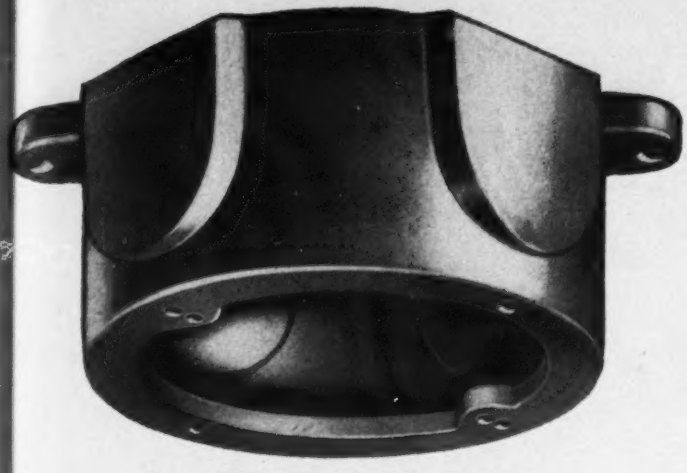
MICRO MS SWITCH

TRADE MARK

Made Only By Micro Switch Corporation . . . Freeport, Illinois, U.S.A.

Type GRF
CONDULETS

(CONDULETS are manufactured only by CROUSE-HINDS)



Type GRF Condulet for Surface Mounting. With Mounting Feet.

Type GRF Condulet for Flush Mounting. With Slotted Holes for Nailing to Concrete Forms.

Adaptable — many uses. Takes blank or hub covers; terminal blocks; many Condulet accessories; standard 4" outlet box covers and wiring devices. Can be used as a

Junction box Condulet
Plug receptacle Condulet
Lighting fixture Condulet
Fixture hanger Condulet

Convertible. At any time after installation Type GRF Condulets can be quickly converted to other uses, as all equipment is interchangeable.

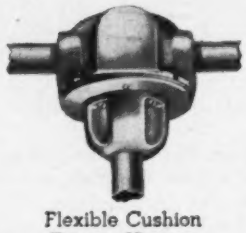
Cast Feraloy (semi-steel). Strong and rigid. Wide gasket surface for tight and weatherproof assemblies.

Bosses for drilling and tapping on sides and back. Will be furnished blank or factory tapped with tapered threads in any arrangement for ½, ¾, or 1-inch conduit.

2 Styles. For flush or surface mounting.

3 Sizes. Inside depth, 1½, 2¼, or 3 inches.

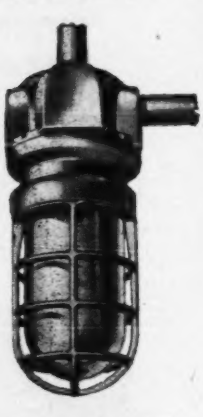
Listed in Condulet Catalog No. 2500, Section 15, Page 31.



Flexible Cushion Fixture Hanger

Plug Receptacle

A Nationwide Distribution Through Electrical Wholesalers



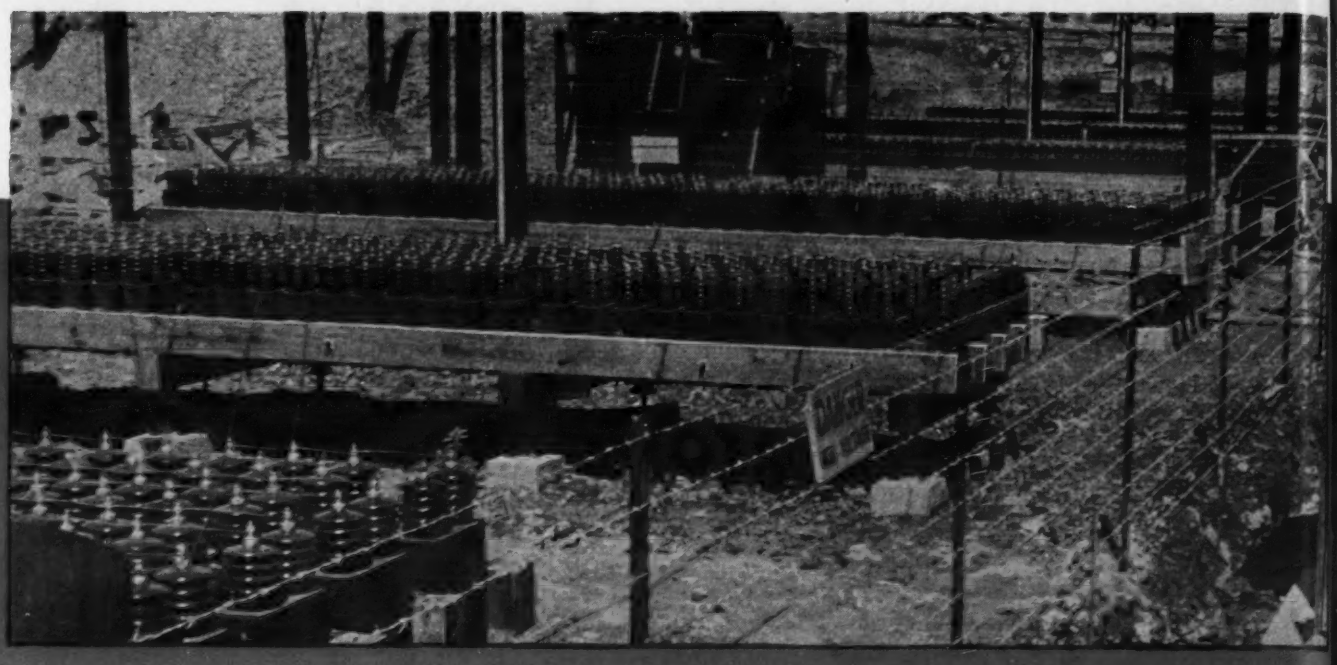
Ceiling Type Vaportight Lighting Fixture

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington
Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

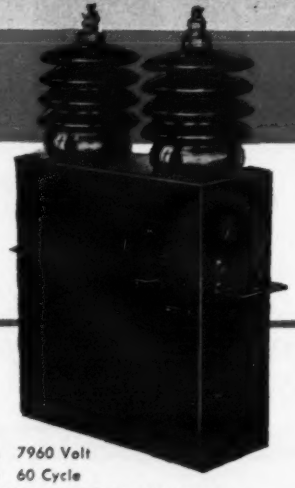
CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

10 REASONS WHY C-D CAPACITORS OFFER THE BEST SOLUTION FOR LARGE BLOCKS OF REACTIVE



1. C-D Capacitors are available on relatively short notice.
2. C-D Capacitors can be located at or near the load with minimum use of critical materials and man-hours.
3. C-D Capacitors will have a very high re-use value elsewhere on the system after the war.
4. C-D Capacitors can be installed and put into operation in a fraction of the time required for other types of corrective equipment.
5. C-D Capacitors are extremely flexible — circuit arrangement will permit the switching of corrective capacity to conform to load requirements.
6. C-D Capacitors are extremely mobile — they can be quickly removed to other locations to relieve sudden unforseen low power factor conditions.
7. C-D Capacitors offer the most efficient reactive source and require minimum of maintenance and attention.
8. C-D Capacitors are durable. Impregnated and filled under vacuum with non-inflammable and non-explosive Dykanol.
9. C-D Capacitors are dependable. Engineered and manufactured by specialists who have made "capacitors" their exclusive business for over thirty-three years.
10. C-D Capacitors have an outstanding record of performance. There are more C-D Capacitors in use today than any other make.

CORNELL-DUBILIER ELECTRIC CORPORATION, SOUTH PLAINFIELD, NEW JERSEY

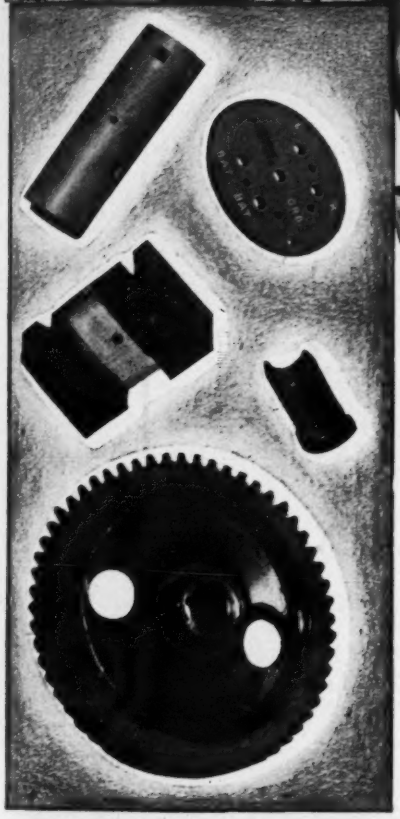


15 KVA 7960 Volt
1 Phase 60 Cycle
INDIVIDUAL OUTDOOR CAPACITOR

Cornell Dubilier

capacitors *for power factor improvement*

carrier current coupling ★ surge protection



The Greeks had no word for it and neither do we, more's the pity. Let's coin a word and a definition by starting with Webster's definition of research—"diligent protracted investigation, especially for the purpose of adding to the sum of human knowledge."

Now let's add, "More especially creation of new substances and discovery of special services they can perform better than any previously known substance".

There you have Formica research which has been going on more than 30 years through peace and war.

Formica laminated plastic has been created in various grades suitable for many uses in many industries. Strength, lightness, easy machinability, dielectric properties, acid and moisture resistance and stable dimensions are characteristic properties which vary somewhat according to the purpose of the grade.

Acquaint yourself with the past performance of Formica and its possibilities for your new or improved peacetime product.

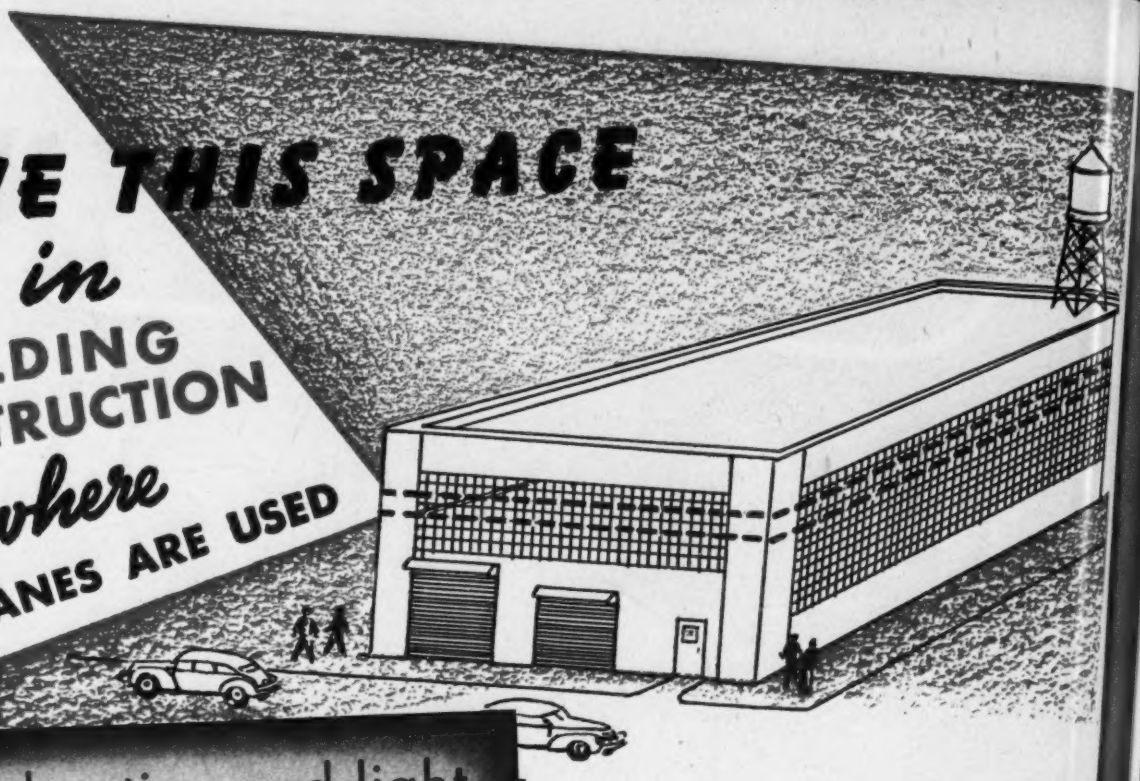
"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it is used. Available for meetings of engineers and executives.

THE FORMICA INSULATION CO.

4630 SPRING GROVE AVENUE

CINCINNATI 32, OHIO

SAVE THIS SPACE *in* BUILDING CONSTRUCTION *where* D-C CRANES ARE USED



Reduce heating and lighting needs—less piping too

THE cost of the horizontal section of building, illustrated above, represents a big investment. To include it means deeper footings, heavier building columns, extra requirements for heating, lighting, ventilating, etc.

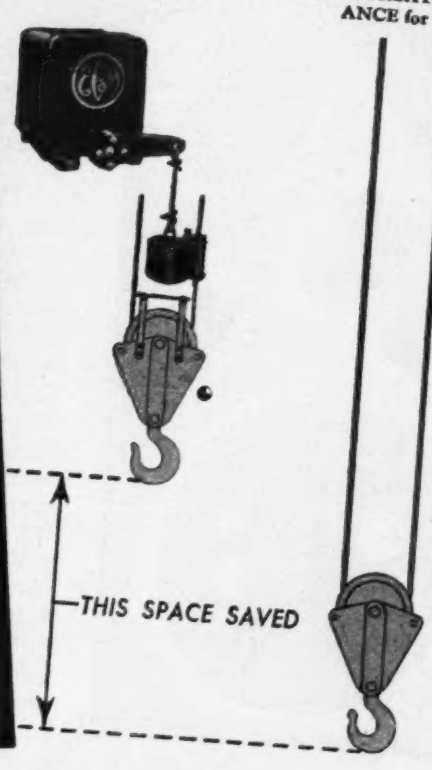
When such a building has D-c cranes geared for high production and equipped with anti-friction bearings, the hoisting speed of the empty hook may be as much as 2½ to 3 times full motor speed. This means that the tripping point for a circuit-opening limit stop must be set with sufficient clearance to insure safe stopping under this worst condition (empty hook at high speed).

The EC&M Youngstown Safety Limit Stop can materially reduce this distance and save construction costs. This Limit Stop not only disconnects the motor from the line but aids the hoist-brake in bringing the hook to rest quickly by dynamic braking. And being operated directly by the hook-block, stretching of the hoisting cables in no way affects the *final* stopping point.

Before planning new buildings, investigate this EC&M Youngstown Safety Limit Stop. Bulletin 1035 gives complete description and shows many interesting illustrations of how it is applied to overhead traveling cranes. Write for a copy.

QUICK-STOPPING type of LIMIT STOP gives MINIMUM DRIFT

CIRCUIT-OPENING type of LIMIT STOP requires GREATER CLEARANCE for DRIFT



E&M

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND ★ OHIO

Keeps Them Going

To all heating devices, their Chromel heating elements might well be called their "staff of life." The heating element alloy, Chromel, just about brought these devices into being, 37 years ago, and has been their faithful sustainer ever since. . . . Fortunate it is, that Chromel is so durable, these days. In fact, if Chromel, the original nickel-chromium resistor, had not been so long lasting—who can say when the device industry would have come alive? For 37 years Chromel has served you well. It is described technically in Catalog-M.

Chromel
NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY • DETROIT 8, MICHIGAN

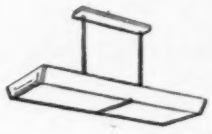
Now Available...

New Westinghouse Commercial Luminaires

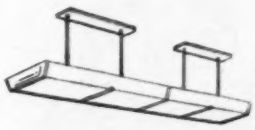
FOUR FLEXIBLE MOUNTINGS

As individual units, mounted flush with the ceiling.

For continuous strip applications, mounted flush with the ceiling.



As individual units, with twin-stem hangers.



For continuous strip applications, with twin-stem hangers.

The new line of Westinghouse Fluorescent Luminaires is available now for essential war applications. These handsome fixtures provide high level, glareless lighting over a wide range of intensities. Their advanced design offers many practical advantages . . . easy installation . . . simple maintenance . . . built-to-last construction.

For example, lamps can be replaced without removing glassware. Starters and ballasts are readily accessible. All glass panels can be removed for cleaning without the use of tools.

This new line of improved luminaires is available on priority order now from 117 Westinghouse Electric Supply Company offices and Independent Westinghouse Lighting Distributors. Get full details—ask for B-3332.

Westinghouse *Lighting Equipment*

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Are you properly emphasizing the SAVINGS FEATURE OF YOUR PLANT'S PAYROLL SAVINGS PLAN?

WITH the war swinging into its tensest phase, now's the time to emphasize over and over again the *savings* feature of your Payroll Savings Plan. To press home to all your people the need of building up their savings—the need of building up their savings not only in wartime but also in the years directly after the war. To point out that a bond cashed before its full maturity is a bond killed before it has given its fullest service to its owner—*or to his country!*

Buying War Bonds, holding War Bonds, and keeping wartime savings mounting—all are absolutely vital. But no one of these is enough by itself. The *savings habit* must be carried over into the years of reconstruction which will follow the war. For if, at war's end, we have 'flash-in-the-pan' spending, *everybody loses.* The spender loses, you lose, and the country loses! While a working public, convinced of the value of continued, planned saving, is the soundest possible foundation for private enterprise of every sort.

We call these bonds War Bonds—and with their aid we will win this war at the earliest possible moment! But they're Peace Bonds, too—and, rightly used, they will win for their holders, *and for all of us,* a happy and prosperous place in the years of peace to come. WAR BONDS to Have and to Hold.

The Treasury Department acknowledges with appreciation the publication of this message by

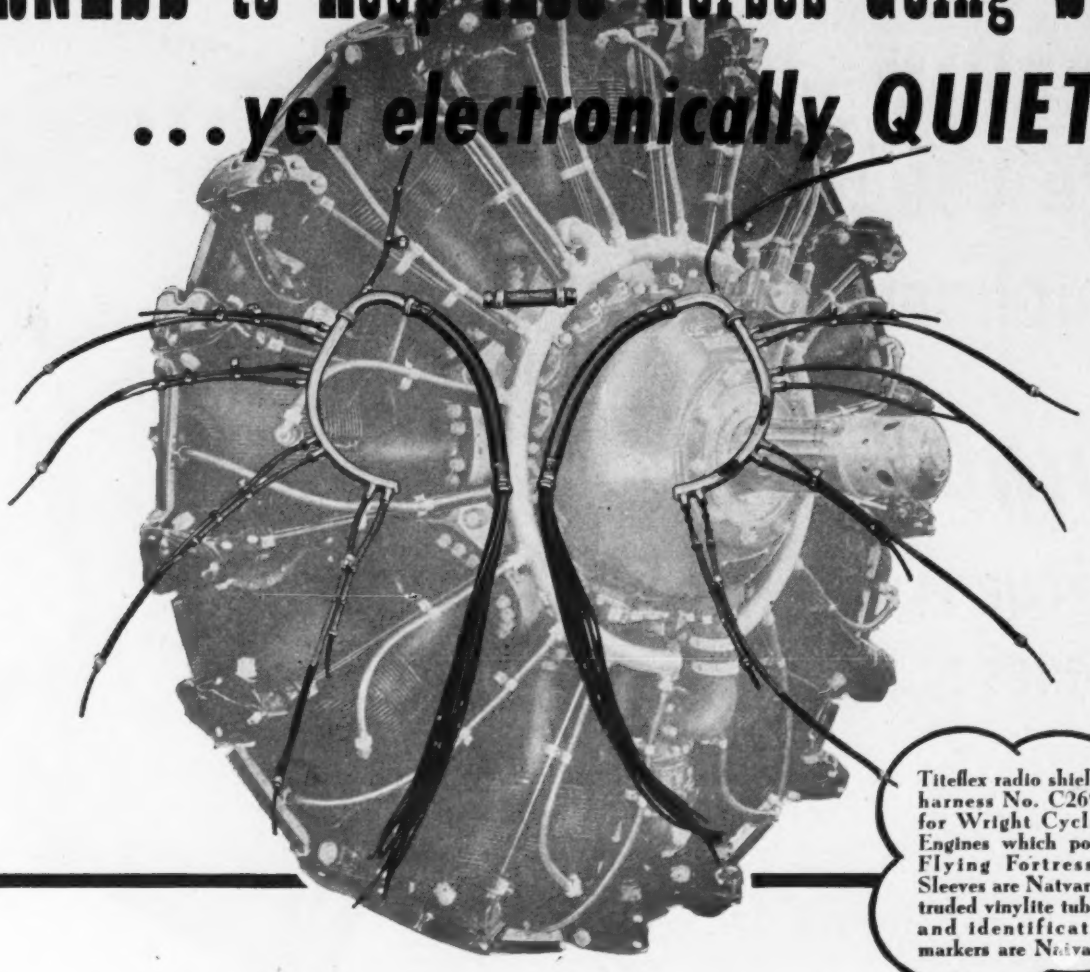
ELECTRICAL WORLD

★ Let's All Back
★ the Attack...
★ with War Bonds!

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

HARNESS to Keep 1200 Horses Going Strong

...yet electronically QUIETED!



Titeflex radio shielded harness No. C26980 for Wright Cyclone Engines which power Flying Fortresses. Sleeves are Natvar extruded vinylite tubing, and identification markers are Natvar.

Titeflex harnesses physically protect high tension ignition systems from magneto to plugs and, at the same time, shield vital lines of communication from the principal source of interference—the ignition system itself.

A tremendous job, when you stop to consider that these Titeflex harnesses perform in a wind stream of over 300 mph—with or without rain and ice, but always subject to vibration. And at temperatures ranging from 50°F. below zero up to 300°F. at the spark plug end!

We are proud of the fact that Natvar extruded vinylite tubings and identification markers are contributing to this performance.

What about *your* requirements? Write, wire, or phone us for deliveries either from nearby wholesaler's stock, or from our own.

Natvar

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished cellulose acetate
- Varnished Fiberglas cloth
- Varnished papers
- Varnished tubings and sleeving
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded Vinylite tubing
- Extruded Vinylite identification markers

Write for bulletins

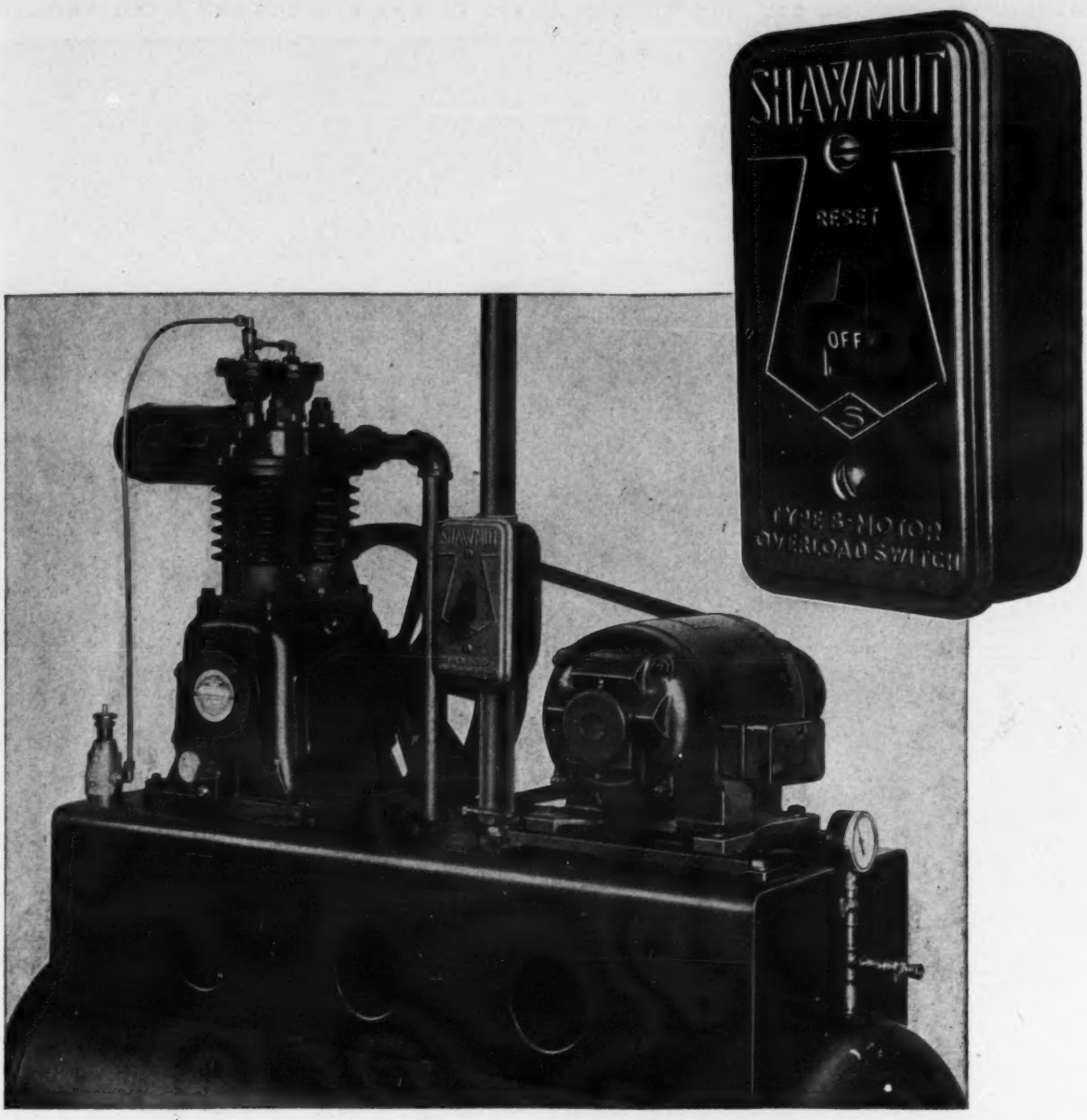
THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE
RAHWAY 7-2171

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE ★ WOODBRIDGE NEW JERSEY

4-NVP-1



ON SMALL COMPRESSORS

it is right where it belongs — as it also is on air-conditioning apparatus, refrigerators, washing machines, fans and blowers, floor polishers, oil burners, saws, stokers, small grinders, small printing presses, small conveyors, and in general on all equipment driven by fractional horse-power motors. The SHAWMUT Type-B MOTOR SWITCH was expressly designed for such service, and is unexcelled in its design for its purpose. Its abundant wiring space makes it easy to install; it is simple and sturdy, without delicate or flimsy wound springs; all its metal parts are rust-resistant; and it is highly durable electrically and mechanically. It gives positive overload protection, and will please you by its convenience and adaptability. For full information, ask for our Bulletin 406.

THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

★ NUMBER 7 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT ROTARY WING PROGRESS

A Kellett in operation-tests with a State Guard Unit, during pre-war maneuvers.

Pioneer . . . Blazing Air Trails

PIONEERING is an American tradition. Every step in America's advance has been made because pioneer spirits first endured hardships to mark new paths—trails that encouraged others to take up the journey.

The scene pictured above is just one of the blaze-marks in the fifteen year trail marked by rotary wing pioneers. The aircraft flying close to tree tops was an early model, direct-control Kellett, demonstrating its ability to hover in a slight breeze, and to take off or land on any open spot of pasture.

Most of this Kellett pioneering was during the most severe depression the U. S. and the world had ever experienced. It required faith to carry on with confidence in the goal ahead.

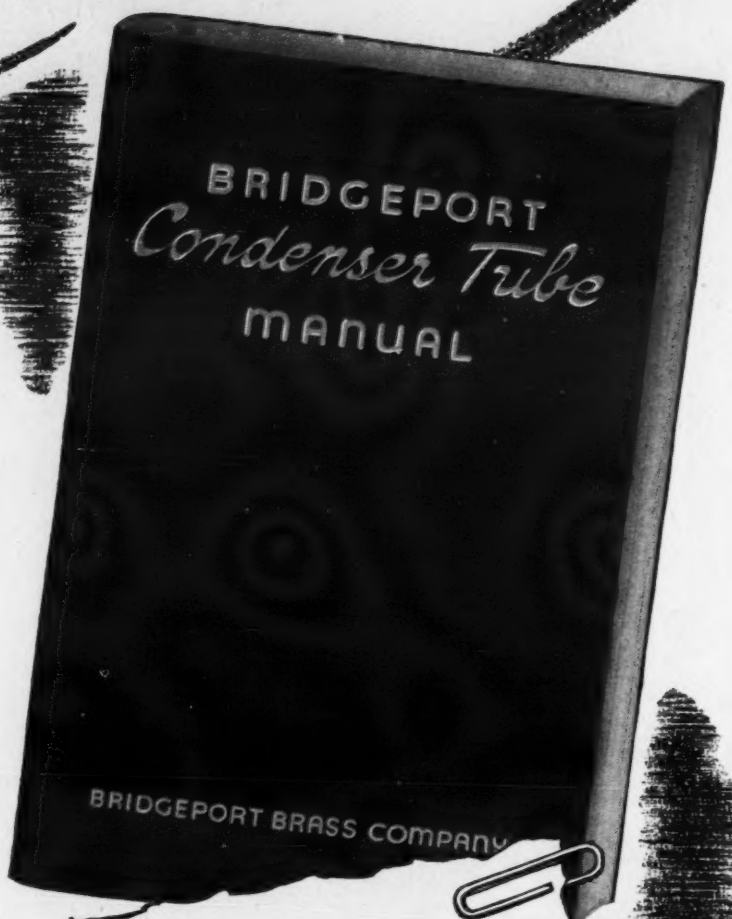
Today, Kellett's expanding staff of engineers, backed by this fifteen years of charting new paths, looks forward to Peace—when developments in rotary wing aircraft will have opportunities to serve in the patrolling and servicing of cross-country electric lines and oil pipe lines, in spraying and dusting agricultural crops, in ranching, forestry fire patrol—and many more ways. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

Eight years ago—a U.S.A.A.F. Kellett taking off from in front of the Operations Hangar, Wright Field, Dayton, O.

K E L L E T T

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

This New Technical Booklet SHOULD BE IN THE HANDS OF Every Engineer and Technician CONCERNED WITH THE Selection and Maintenance of Tubing



Much new and heretofore unpublished information on copper-base alloys that should be of great help to everyone concerned with the selection and maintenance of tubing for installations in condensers, heat exchangers, evaporators and for general piping.

The manual deals with comparatively new and more corrosion-resisting alloys, such as Duronze IV, Cupro Nickel, Cuzinal, as well as improved Admiralty, Muntz, and Copper.

A special feature is the section devoted to a detailed discussion on corrosion which has been digested from technical reports covering extensive tests conducted by Bridgeport over many years. Among the subjects covered are the effects of film deposits, oxygen and debris, impingement corrosion, galvanic corrosion and protection, influences of temperature, water composition and rate of flow, and presence of minerals, carbon dioxide and sulphur. Stress corrosion and corrosion fatigue are also discussed.

The manual contains the latest A. S. T. M. and Federal Specifications on standard alloys, comprehensive weight tables, steam notes, methods of installing and packing, cutting and removing condenser tubes. It also contains weight tables and data on brass and copper pipe, copper water tubing and navy type copper tubing.

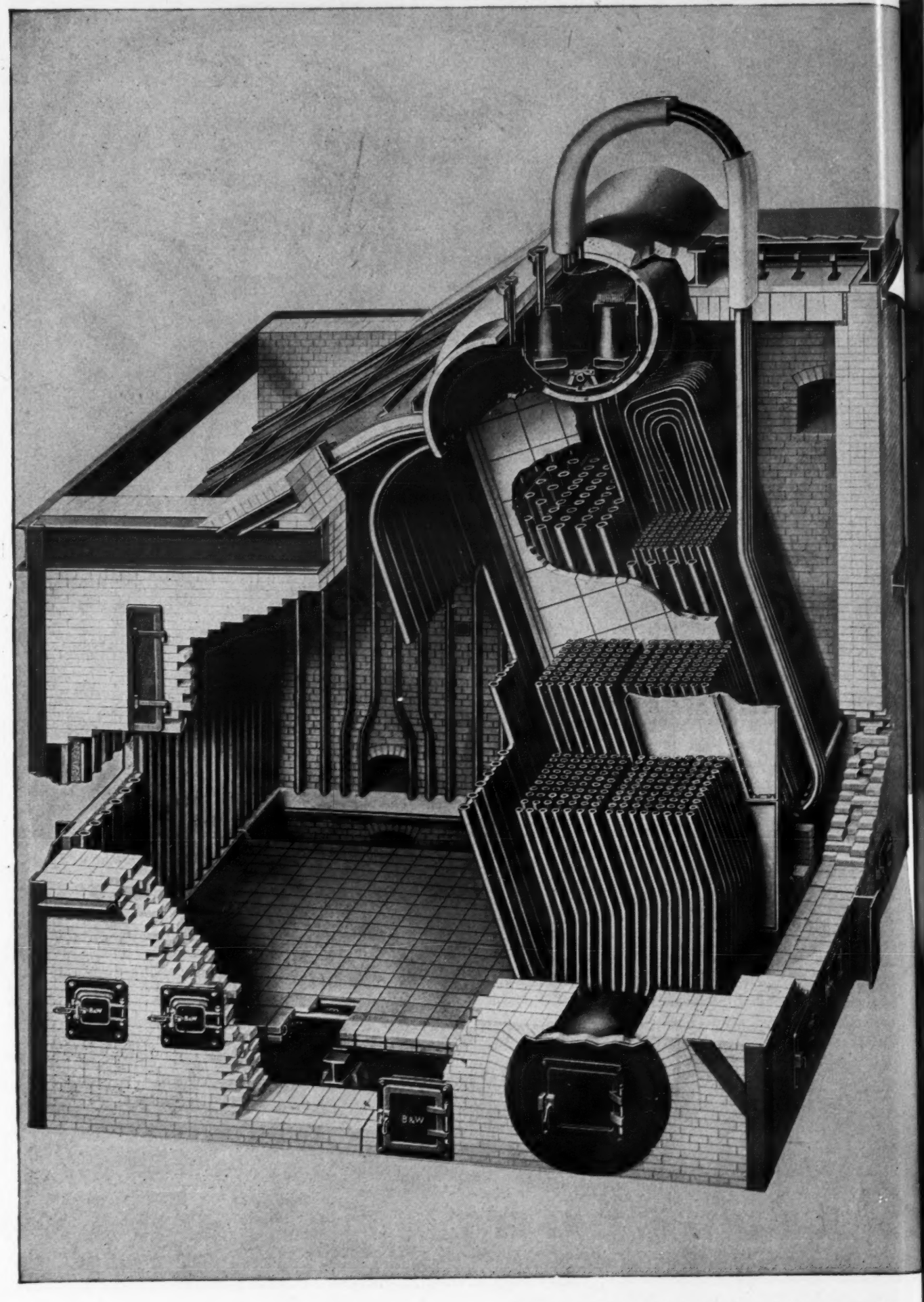
Send your request on company stationery.

HANDY, POCKET-SIZE
112 PAGES, 39 PHOTOGRAPHS
29 DIAGRAMS, 23 TABLES

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ESTABLISHED 1865


B&W

THEIR DEPENDABILITY IS TWICE PROVED

In steel mills, chemical plants, refineries, ordnance plants, aircraft factories . . . wherever American industries are busy producing weapons of war, Babcock & Wilcox Integral-Furnace Boilers are supplying steam with utmost dependability and efficiency. Thoroughly tried and proved in pre-war services, these boilers are now further demonstrating their high availability for service and consistent reliability in a second set of tough assignments.

Faithful performance has been made certain in these B&W boilers by distinctive design and construction features such as:

1. Water-cooled furnace sidewalls and roof of the same durable stud-tube construction used in large central-station boilers.
2. Deep furnace, fired from one end, provides ample space for complete combustion.
3. Bare metal blocks cover and protect the tubes of the water-cooled furnace floor, and provide a surface readily cleared of ash.
4. Self-draining super heater design prevents accumulation of water in the tubes and assures steam flow through all tubes on starting up.
5. Tubes of the third bank, which is in the zone of coolest gases, act as downcomers, insuring rapid positive circulation at all loads.

From their additional war-time proving under unprecedented service conditions will come still better B&W Integral-Furnace Boilers to serve post-war industry.

THE BABCOCK & WILCOX CO., 85 LIBERTY STREET, NEW YORK 6, N. Y.

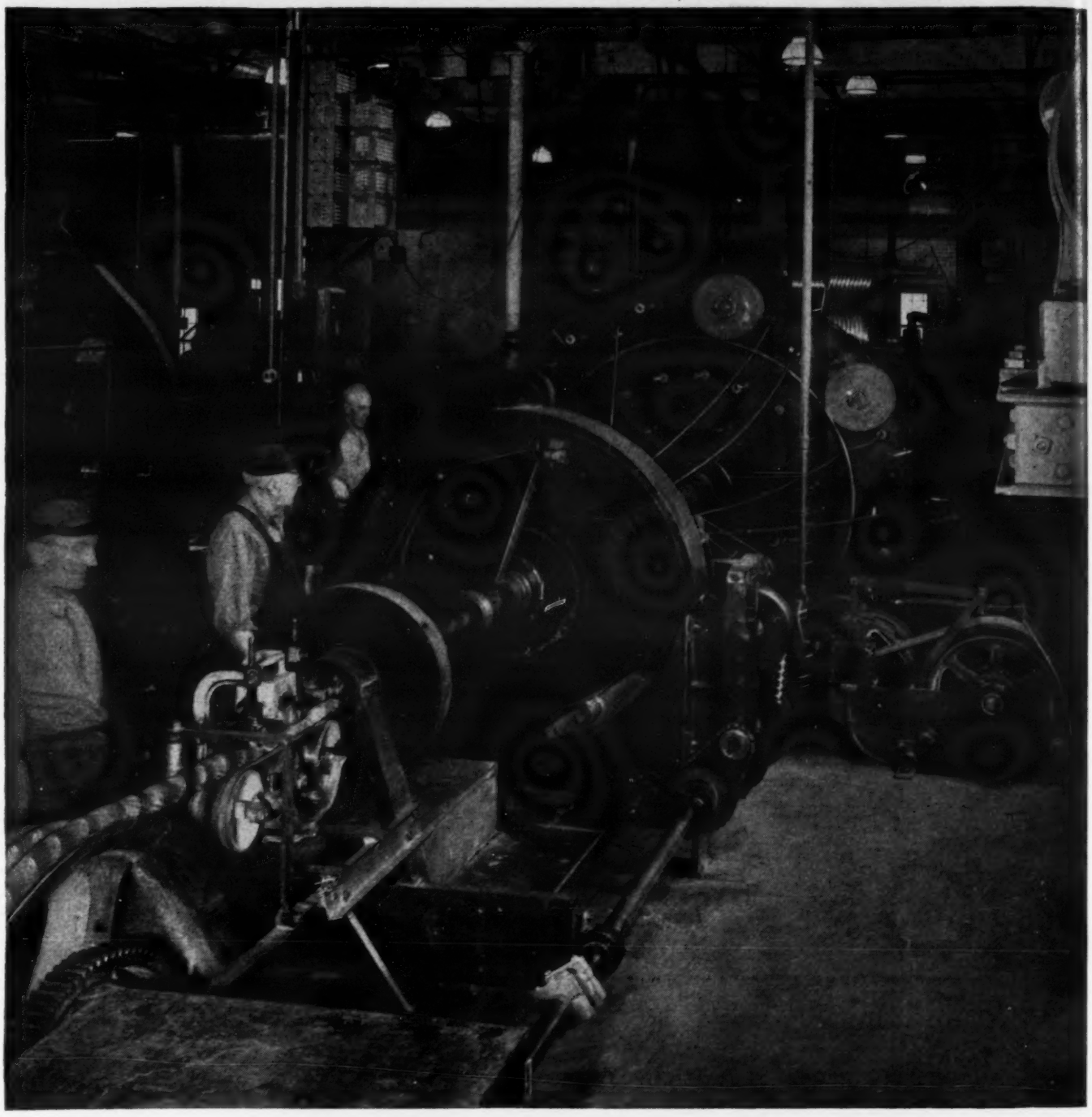
For additional information on B&W Integral-Furnace Boilers, send for Bulletin G-17-A.

★ BUY MORE WAR BONDS! ★

BABCOCK & WILCOX

G266 T

Pioneers in Cable Engineering



CONSCIENTIOUS WORKMANSHIP

UNDER SKILLED SUPERVISION

is indispensable to quality of production
in insulated cable manufacture.

THE KERITE INSULATED WIRE & CABLE COMPANY INC

NEW YORK CHICAGO SAN FRANCISCO

Disposal of Government War Plants *and* Equipment

In the last four years, the Federal Government has spent over fifteen billion dollars on war plants—two-and-one-half times as much as was spent by private investors.

Of this fifteen-billion-dollar government investment, about one-third has gone into facilities for the manufacture of aircraft and for ship construction and repair; another third has gone into plants for production of combat ordnance; and the remaining third has gone into a variety of facilities for making synthetic rubber, metal products, machinery, and miscellaneous equipment.

Most of these plants are in industries that are expanded far beyond peacetime requirements. Furthermore, their convertibility to other civilian uses will, in many cases, be complicated by their specialized equipment and layout, by their tremendous size, and by their uneconomic location. At the moment, it looks as if roughly one-third of the government-owned plants and equipment can be converted fairly readily to peacetime operation, and will, therefore, be easily disposable to private enterprise.

The discovery of unsuspected uses for war plants and equipment may well raise the disposable proportion to one-half or more. The government, at the end of the war, may own about one-eighth of the commercially-usable industrial capacity of the country. It will be by far the largest owner of machine tools; it will own enormous aluminum capacity, magnesium capacity, many miles of pipe lines, and more ships than the entire private shipping industry.

What the government does with its war plants will have a profound effect on the free enterprise system and on all workers, employers, investors, and consumers who have a part in that system. If this problem is handled badly, we may find ourselves enmeshed in a trend toward monopoly and government operation of industry. If the problem is handled well, we shall have taken a big step toward freedom of action in a competitive society, toward full opportunities for business enterprise, toward well-paid productive jobs for workers, and toward a higher standard of living for us all.

Recently, three important events have signalled encouragement. They are the report of Senator George's Committee, the Baruch report, and the report of Senator Truman's Committee. These reports are noteworthy for their competent sizing up of a complex problem, for their recognition of the major responsibility of government in making a successful transition to peace, for their insistence on wise policy and good administration, and for their genuine concern that our productive powers be given full opportunity in a free private enterprise system. These reports agree on basic principles and many specific lines of action. There are, however, important areas of policy formation, organization, and procedure—especially in regard to plant disposal—which remain to be blue-printed.

In formulating the policies and practices to be followed in dealing with government war plants, our major goal must, of course, be a high level of production and employment in private business after the war.

Government operation in competition with private employers and privately-employed workers will not be desirable because it will make investment unattractive to private capital and will limit opportunities for private employment. On the other hand, sales to private buyers which result in increasing the concentration of industry will also be undesirable. We must use this opportunity to strengthen the competitive enterprise system and to move away from, not toward, the concentration of economic power in either public or private agencies.

To accomplish these objectives, a program of action such as follows will be necessary:

1. An adequate reconversion organization will be needed in the government, but its powers and responsibilities should carefully be defined by Congress. Fortunately, an able Administrator of Surplus War Property already has been appointed. It will be essential for him to work in closest cooperation with Congress and with the Armed Forces and other executive agencies. The Office of War Mobilization, and ultimately the President, must be responsible for seeing that the Surplus War Property Administration is not sidetracked by the operating agencies and is not dominated by their sheer size. Funds must be supplied generously to the Surplus War Property Administrator, so that he can set up an organization adequate to cope with this huge and complex job. Business, too, must be generous in loaning top-flight executives for postwar government service.

2. One of the first acts of the Surplus War Property Administration will have to be to assemble a complete inventory of government war plants and equipment, to make possible the planning and control of the disposal process, and to form the basis of catalogues of property available for sale.

3. Cooperation between the executive and legislative branches of the government will be needed to develop at least tentative plans with respect to matters of public policy which are of special importance to a successful transition to peace. Among these matters are the size of the military establishment to be maintained in time of peace, the stand-by facilities and reserves of materiél necessary for our security in case of future war, and our policy regarding import and production of synthetic rubber and other critical and strategic materials.

4. The Surplus War Property Administrator should

obtain from the Armed Forces, acting under congressional directives, specification of those plants which are needed to supply our peacetime Army and Navy and to provide the essential reserve capacity in case of war.

5. The Surplus War Property Administrator should select certain war plants as depots in which to store the huge surpluses of inventories and equipment which will have to be removed from private and government-owned factories in order to make possible their conversion to civilian use.

6. Those plants which are not desired by the Army or the Navy, which are not needed for storage, and which clearly will be unsuitable for peacetime utilization should be scheduled for dismantling and disposal piecemeal.

7. The two or three billion dollars' worth of government facilities intermingled with private plant should receive attention with a view to early sale, temporary continuance or use under lease, or early removal.

8. The various plants and pieces of equipment available for sale to private business should be classified conveniently, catalogued, and advertised to prospective buyers or lessors. Before the Surplus War Property Administrator offers, for private sale, plants and equipment not desired by the Army or the Navy, he should ascertain whether the plants or equipment are desired by other branches of the government or by public corporations such as the T.V.A.

9. Whenever property can be sold at prices approximating depreciated reproduction cost, that will be by far the best solution. Generous time-payment terms should be offered. In many cases the government may be unable to sell the property for reproduction cost less depreciation, for the simple reason that no one would think of reproducing it. The property may already be partly obsolete or, because of its size, location, or other characteristics, may only be moderately well suited for commercial use. This should not prevent the government from selling it, provided a price which fairly represents the worth of the property can be obtained. The best test of that worth is the price produced by active bidding under favorable market conditions.

10. When property cannot be sold at a fair price, temporary leases with options to buy should be employed to get the facilities into productive use. This should not, however, be done on terms which would cause unfair competition or create clearly excessive capacity in an industry. And the lease must be temporary; it must not be the means to prolong government control or ownership.

11. The government should offer the strongest possible resistance to local groups or industry groups seeking subsidies for continued operation of war properties. Subsidies will burden the Treasury and lead to inefficient use of resources. They will be justified only to maintain facilities needed for national security.

12. The plants and equipment offered for sale and lease should include sufficient quantities in small enough lots to satisfy the demands from small business. The war has tended to concentrate production in larger plants. After the war, we should seek a wider distribution of the government war facilities.

13. Insofar as possible, war buildings and equipment should be offered for sale in units which can be purchased by businesses in peacetime industries. Many of these industries have had to get along during the war without adequate replacement and expansion, and will be ready to buy if they are able to get what they want from the government. This is a particularly desirable market for surplus government property since these industries are, for the most part, not faced with the problems of excess capacity.

14. Property, such as machinery and other movable equipment, which is in excess of our domestic requirements or is more urgently needed by other countries, should be exported. We shall need, and can take, large supplies of raw materials in return.

15. Property which is not needed by the Armed Forces, which cannot be sold or leased on terms which would be fair to competing plants, which cannot be dismantled and distributed piecemeal, and which cannot be sold abroad, should be scrapped as soon as its non-disposability is apparent. The disposal of war plants should be completed within three to five years.

16. All negotiations for sale or disposal should be matters of open public record. As Mr. Baruch has said, the process must be conducted in a goldfish bowl. This is as much for the protection of business as for the protection of the government.

These courses of action do not include everything that must be done, but they do indicate the general lines along which our surplus war plant disposal must proceed if it is to avoid precipitating needless transition unemployment.

The gravest danger of all will be red tape, intergovernmental conflict, and inadequate administration. It would be a great misfortune for the executive and legislative branches to quarrel over details of organization when they agree on the basic principles to be followed in handling the problem. Obviously, the Surplus War Property Administration must cooperate with Congress and look to it for policy guidance. Just as obviously, the disposal problem will involve great difficulties of administration which must not be complicated by congressional interference. We shall need the best we can get in careful policy making, detailed planning, good organization, and courageous action. This is a matter of vital importance to every American. The stakes are too high to tolerate poor administration or petty politics.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

Yesterday's Pilots

For some time we have been urged to suggest that the elder statesmen who have been at the helm so long turn the guidance of the industry's collective activities over to the younger operating company executives who will have to be our post-war pilots.

Older men, it is argued, are cautious and slow to accept change. Because most of their lives are behind them their visions are too apt to be dreams of past glories instead of new horizons in the future. The industry, however, cannot live in the past. It must live in today while it is making ready for tomorrow, and it takes young men to face tomorrow eagerly.

For the past several years the industry's opposition has been lead by young men with a new kind of thinking against which older men have had little defense. Minds that are filled with the past are more likely to seek shelter from attack behind the walls of precedent which in the past decade have proven to be extremely vulnerable. Young minds, on the other hand, sensing from this war that battles ultimately are won by new kinds of tactics, are impatient at doing nothing —at hiding.

There is a growing group of these younger executives who are eager to run the risks, but they want to call their own plays because it is their future and the future of those under them that is at stake. Why shouldn't they take over? Of course, they will make mistakes, but can they make any more or lose any more ground than some of their seniors have in the past decade or more? Unless all the ability and all the right is on the side of the opposition it is quite as likely that the new leaders might even regain some of the lost ground.

If this industry is to grow fast enough to keep ahead of its pursuers, it must have people with vision that is bigger than anything we have seen in the past. It must have leaders who are not discouraged but who still believe that there is opportunity ahead, who are young enough to love to fight for it and strong enough to see the battle through.

Today we are facing the problems of peace which are always more difficult than the problems of war. Life will not be the same as before the war. There will be great changes, to meet which we must have leaders who welcome the new. Today is the planning time for tomorrow. Who is going to make those plans? Who is going to decide whether they are to be carried out? Is the decision going to be made by those who have no future, or by those who must live in and with the future and make it work?

We are not one of that group who would break completely with the leadership of the past, because our elder leaders have given liberally of themselves to this industry and have prepared for the next generation a strong industry which comes out of the war with a record second to no other industry in this country. Nor are we willing, even though conditions are changing, to disregard the counsel of experience, even though it might not be asked to direct.

Just the same, the cautious hands of age must not restrain the eager arms of these younger successors whose destiny is tomorrow.

Higher-Voltage Distribution Successful in Dallas-I

Post-war significance of 447 miles of 13.2-kv. radial common-neutral primary serving 15,000-kw. load in 106 square miles from subtransmission system. Adopted after fundamental comparison with prior plan for 4 kv. fed through numerous substations

H. K. DOYLE, Operating Superintendent, Dallas Power & Light Co. and
W. R. BULLARD, Electrical Engineer, Ebasco Services, Inc.

WAR SHORTAGES have focused attention on the possibilities of saving materials and reducing costs by making use of higher voltages. One phase of this subject is the growing practice of employing primaries of the 11-13-kv. class for general purpose radial overhead distribution. Such voltages have been used extensively in the past for rural distribution and overhead distribution in small towns and villages; also in cities for subtransmission systems, including direct service therefrom to large industrial customers, and for primaries of underground low voltage a.c. network systems. However, it is only within recent years that the use of these higher voltages for overhead distribution in residential and light commercial areas of cities has gained substantial acceptance among operating companies, and little or no information regarding experience from actual operation of such systems has been published.

In view of the timeliness of the subject, both from the standpoint of the war emergency and that of post-war planning, these articles have been written to make available information and experience data concerning a rather extensive 13.2-kv. distribution system serving some of the best residential districts of a city of the southwest.

Dallas, Tex., is a marketing, manufacturing and transportation center with a present population of about 350,000. It serves a large agricultural area which produces principally cotton. It is adjacent to extensive petroleum producing areas and is an important oil refining center. It is located on gently rolling terrain.

Prior to 1937 the general purpose overhead distribution system of Dallas was of the conventional radial type with 2.4/4-kv. primaries served through transformer substations, stepping down from the subtransmission voltage of 13.2 kv. Since 1926 the principal business area has been served by a low voltage a.c. network having 13.2-kv. primaries.

In 1936 when the country was emerging from the depression and load increases began to tax the capacities of distribution facilities, Dallas Power & Light Co. made a study for the purpose of developing long range plans for the expansion of its overhead distribution system. Predepression plans for expanding the 4-kv. system along

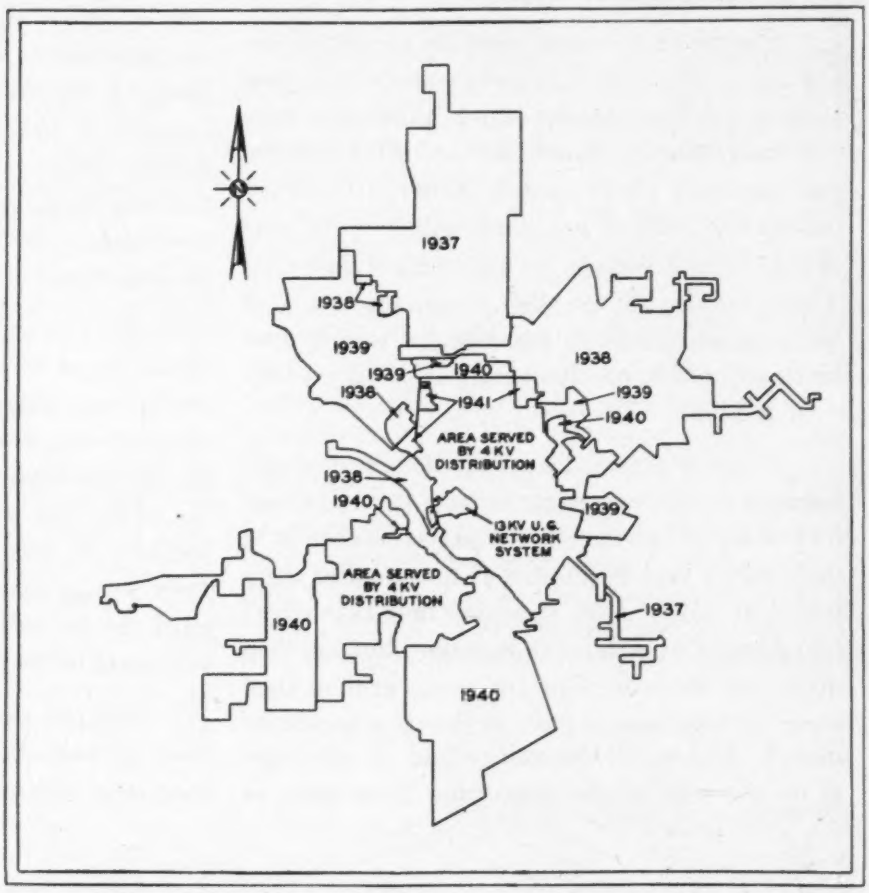


FIG. 1—Dallas, with population of 350,000, is surrounded by cotton and petroleum areas. Dates of conversion from 4 to 13.2 kv., initially in high-class residential area and later in light commercial-industrial areas

conventional lines were available, but it was desired to make a more fundamental approach to the problem, and in particular to make a critical examination of the merits of the existing primary voltage as compared with the use of the subtransmission voltage of 13.2 kv. for primaries, permitting the elimination of one voltage transformation. A typical residential area was selected for the study, and an economic comparison, projected over a number of years of estimated load growth, was made of the following three types of systems for serving the specimen area:

(a) 4-kv. primaries served through 2,500-kva. unit type transformer substations.

(b) 4-kv. primaries served through 1,500-kva. unit type transformer substations.

(c) 13.2-kv. primaries served directly from the subtransmission system.

This comparison showed that substantial savings could be made by a gradual conversion from 4-kv. to 13.2-kv. primaries, at a time rate sufficient to absorb all load growth and to retire 4-kv. equipment as it reached the end of its useful life. The study also revealed that the 13.2-kv. primaries would provide substantial improvement in electrical efficiency of the distribution system and substantially greater flexibility and adequacy for handling a growing load.

The alternative was the continuance of expansion of the 4-kv. system with large expenditures for new transformer substations in prospect within a relatively short period of growth.

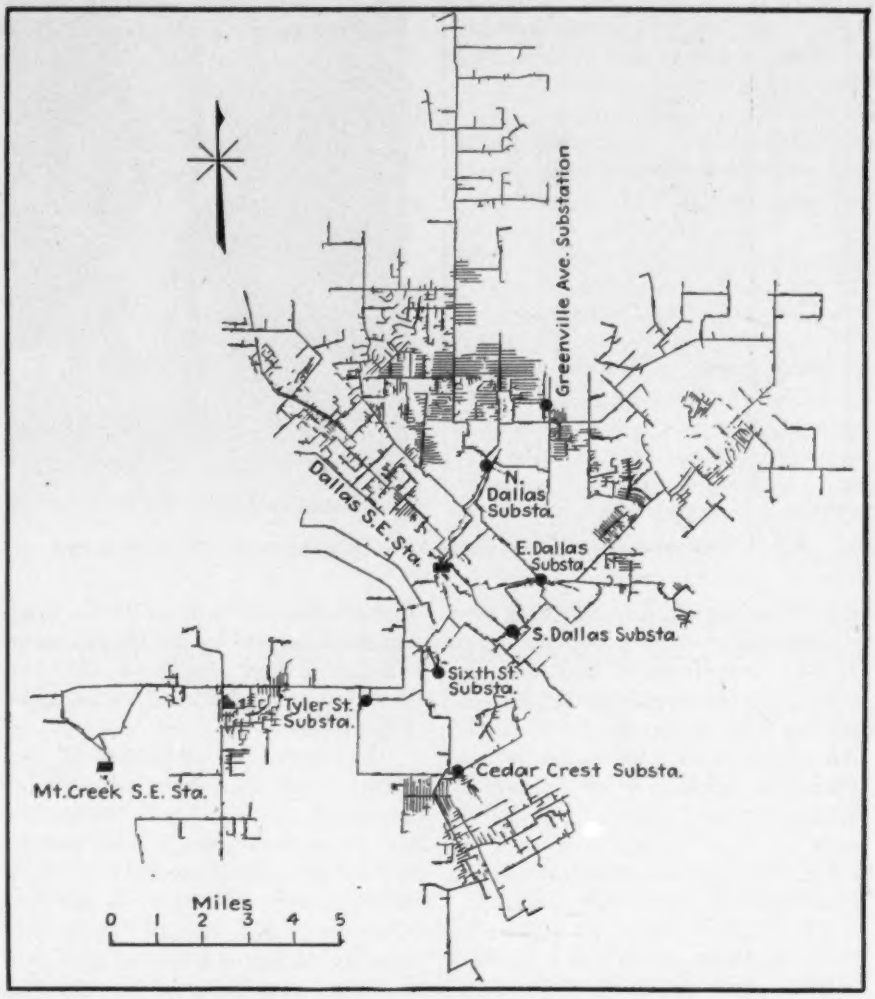


FIG. 2—One line geographic diagram of radial 13.2-kv. primary circuits and location of the substations retained to serve the unconverted 4-kv. areas

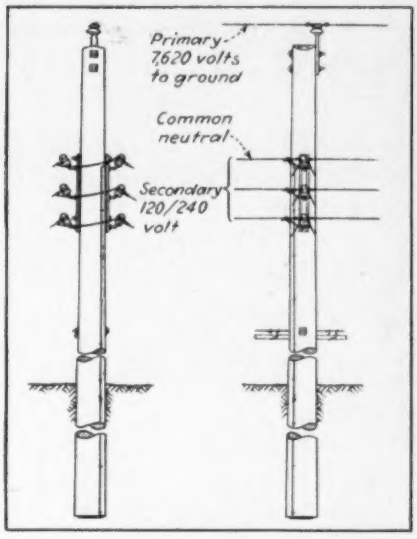
Introduction of 13.2 Kv.

As a result of this study it was decided to try out the higher voltage primaries by converting a small area from 4-kv. to 13.2-kv. operation. The area selected was a newly developed and rapidly growing residential district at the northern end of the city. This is designated on the map Fig. 1 by the numerals 1937, indicating the year in which the conversion was made. This area at the time constituted a moderately high class residential section. The load was of usual residential type, chiefly single phase, and amounted to about 500 kw. The circuit mileage involved was approximately 26 miles.

A study was made jointly with the local telephone company with the assistance of representatives of Edison Electric Institute and American Telephone and Telegraph Co. to determine the feasibility of joint use of poles at the higher primary distribution voltage. This resulted in agreement that by coordinating the protective measures on both systems, joint use could be continued under conditions satisfactory from the standpoint of safety to the telephone system. The study covered the magnitudes of voltage rise upon contact between telephone and power circuits and the arrangements for prompt disconnection of the power circuits. The overcurrent protection of power circuits involved included induction type phase relays with a setting of 360 amp. and No. 1 time lever setting, with an instantaneous attachment for currents of 1,500 amp. or more. These relays were supplemented by ground relays of the "very inverse low energy" type with a setting of 100 amp. and No. 2 lever. Sectionalizing fuses of 60-amp. and 30-amp. sizes were proposed for locations where circuit conductors changed materially in size. Grounding conditions and circuit impedances were such that the maximum voltage on telephone cable and associated drop wire in case of contact would be approximately 2,000 volts. In the case of open wire telephone circuits it was considered advisable to place at least one special protective gap on each of such circuits.

The conversion of this area to 13.2-kv. operation was completed in 1937, the method of conversion being as follows:

First, the conductors were reinsulated for the higher voltage. This was done with lines energized. Second, the new transformers were placed in position and made ready for connection to primary and secondary circuits. Third, the cutover was accomplished in convenient sizes of circuit sections during short periods of service interruption by placing a workman at each transformer installation, de-energizing



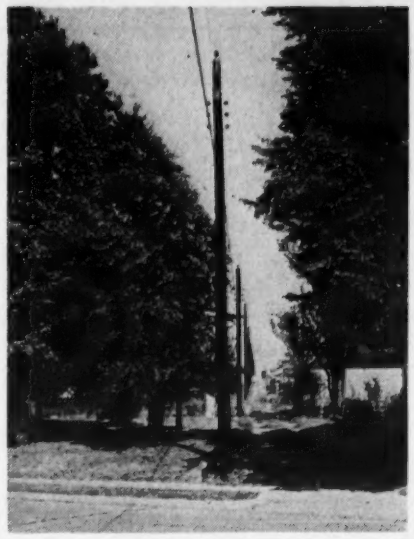


FIG. 3—Typical design of single-phase pole—pole top detail and an alley run

the circuit section, disconnecting 4-kv. transformers, connecting the new 13.2-kv. transformers and then re-energizing the circuit section by connecting it to its new source of supply. All of this third stage could be handled in a period of a few minutes by means of visual signals passed from man to man through the area involved. Fourth, 4-kv. transformers and auxiliary equipment were removed.

The 13.2-kv. source of supply for this initial conversion was a conveniently located circuit of the existing subtransmission system which was merely tapped for the purpose through suitable fuses. The load picked up in this manner helped relieve the burden on 4-kv. substation equipment. At the same time, by augmenting the transformer capacity in some of the existing stations, and by the liberal use of 4-kv. pole-type capacitors, the construction of additional substations was avoided.

The successful operation of this initial installation paved the way for expanded use of 13.2-kv. primaries, and by adjusting the rate of conversion to that of load growth it has been possible ever since to avoid the construction of any new 13.2/4-kv. substations. In fact the last of such substations was constructed in 1926. The method of expanding the 13.2-kv. system has been that of converting 4-kv. circuits area by area, placing in stock 4-kv. equipment thus removed for use in unconverted 4-kv. areas to provide for load growth and replacements.

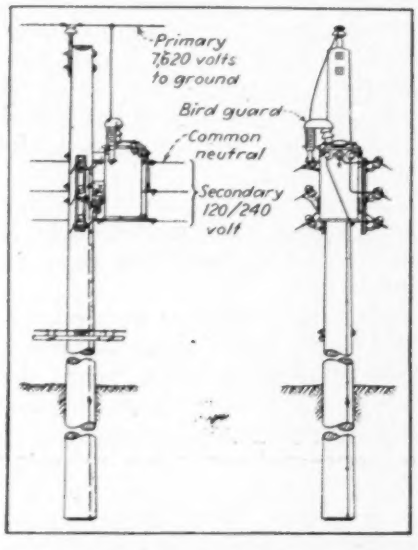


FIG. 4—Transformer installations for 13.2-kv. system—(left) single-phase pole top details; (right) single-phase-unit on pole jointly used by telephone circuits

The fringes of the system were selected for the first periods of the conversion program and the encroachment upon the 4-kv. system therefore is progressing from the outer edges toward the center.

Present 13.2 Kv. System

Up to the present a ring of territory in the outer sections of the city has been almost completely converted to 13.2-kv. operation. This includes some of the best residential districts of the city as well as some light commercial areas and scattered industrial loads. The area covered is some 106 square miles. The map Fig. 1 shows the boundaries and indicates areas included in annual conversion programs by individual years.

Fig. 2 is a one line diagram of the entire 13.2-kv. system shown geographically. By reference to this diagram in conjunction with the map of Fig. 1 an idea can be obtained as to the relation of the general purpose distribution circuits in the residential areas to the subtransmission system.

The present 13.2-kv. distribution system, exclusive of subtransmission circuits, includes 447 miles of circuit, single phase and three phase. The total load served amounts to about 15,000 kw. classified approximately as follows: residential, 53 percent; commercial, governmental, and industrial, 45 percent; rural, two percent.

The three-phase sections of the 13.2-kv. circuits are of conventional cross-arm construction with lateral spacings of 29 in. between conductors. The single-phase laterals in medium or high class residential districts are of pole pin construction when practicable. Secondaries in general are carried on vertical racks on which the common multi-grounded primary and secondary neutral also is carried. In the newer construction, both primary and secondary conductors (except services) are bare. A typical single-phase pole design is shown in the sketch Fig. 3, and an idea of the general appearance can be obtained from the photograph Fig. 3. The secondary rack shown is of low cost design developed by the Dallas company primarily to make use of a surplus stock of insulators. A typical design of single-phase transformer installations is shown in the sketch Fig. 4 and an actual installation is pictured in the photograph Fig. 4.

Street lighting circuits are of the

series type and are carried on the same crossarms as the primaries. Where the latter are three phase, six-pin crossarms are used with only four pin spaces occupied, the street lighting circuit being carried on the end pin on the street side. Where the primaries are single phase, only two pin spaces are occupied, with the series circuit on the street side.

Practically all single-phase transformer installations utilize 7,620-volt transformers of the self-protecting type, including arresters or deion gaps for lightning protection, and secondary breakers, together with fusible primary links, for overcurrent protection.

All of the transformer tanks are grounded. The majority of single-phase installations are paralleled with other units on the same sections of secondary mains, the maximum number of units on one section being about four. Where the self-protecting type transformers are connected to trunk sections of primary line, fused cutouts are used in addition to the internal fusible link. Where they are fused on branch circuits no cutouts are used, connection to the line being made through jumpers terminated by "hot-stick" clamps.

Service Protection

At the beginning, the primary circuit overcurrent protection consisted of phase and ground relaying at the station, together with sectionalization by single-shot fuses, as described previously in connection with the discussion of joint use of poles. Later it was found advantageous to use three-shot reclosing fuses for protection of some of the branch circuits. More recently the "coordinated fuse-breaker" method of protection has been tried and has been so successful in providing service continuity of high quality at low cost that it is favored over all other methods. This method consists of an initial opening of the station breaker sufficiently rapid to avoid blowing a branch or sectionalizing fuse. An immediate reclosure, if successful, then is followed by a second opening sufficiently slow to allow the fuse to blow without breaker opening if the fault is on a fused section. This basic cycle may be supplemented by second and third reclosures before lockout, or lockout may occur on the second opening, depending upon the automatic equipment available.

Insofar as service continuity is concerned, this method has somewhat the effect of a number of reclosing circuit breakers controlling the sections of an individual circuit, but at the cost of only one reclosing circuit breaker at the station plus a number of single-shot sectionalizing fuses. Disregarding momentary interruptions as of little consequence, service is maintained on all sections of a circuit except one in which a fault of a permanent nature has occurred. If the fault is only momentary, service is restored at once to the entire circuit.

Five of eight circuits comprising the 13.2-kv. general purpose distribution system are now equipped with this type of protection. Three are equipped for triple reclosures, and two are equipped for single reclosures. The latter are in attended stations and additional reclosures can be made by hand if desired. Fusing practice on these circuits consists of the use of both branch circuit fuses, and sectionalizing fuses in trunk lines. Extensive branches may be further subdivided by branch or sectionalizing fuses. With this plan there may be as many as five fuses in series. These are coordinated with each other and with the timing of the station breaker.

Voltage control is accomplished on two of the eight feeders by means of step regulators. The remaining circuits have only station bus regulation. This is in contrast with the 4-kv. system in which all feeders are individually regulated.

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Conduction Paint Prevents Wood Pin Burning

By C. C. MOLER
Distribution Engineer, Potomac Edison Co., Hagerstown, Md.

Before we began changing 6.9 kv. delta lines to 12 kv. star (6.9 kv. to multiple grounded neutral), we considered the switches, regulators, cables, transformers, tree clearance and insulators, but it did not occur to us to consider the wood pins. We had amply rated insulators on most of our lines and even the smallest ones appeared satisfactory.

For a while after we began changing over we had a few cases of pin burning, but without much investigating attributed them to small or bad insulators or bad contamination. We had had occasional pin burning before. Therefore, the matter was not taken seriously until about two years ago when we had to remove over 30 miles of circuit from an area to be occupied by a large ordnance depot and were surprised to find extensive burning. It was found on lines of from one to seven years since reconnecting, and under insulators from the poorest to the best. Soon after we had launched an investigation some lines which had been up only six weeks with best rated insulators were found showing some pin burning.

Our investigations, which are still in progress, consist in part of a test with elevated voltage on 60 pins and insulators exposed to the weather. The pins are divided into five groups, four given different treatments and one remaining untreated. The pins are fastened with one nail each in wood arms which have a metal strip along one side. Sixty insulators, including 13 different types, are on the pins and a No. 4 copper wire is run over all and tied. This wire is connected to one side of a 14,000-volt source and the metal strips on the arms are connected to the other side, which is well grounded.

After being energized and exposed to the weather more than eight months, none of the pins treated with O-B Conduction Paint No. 608 show any signs of burning or wood digestion, while all of the other pins show considerable burning and some of them the beginning of wood digestion. Some pins showed slight burning in one week and all except those with conduction paint showed some burning in two weeks. This is not of course a test of the decay-resisting properties of the other treatments, but it shows that they are unsatisfactory in preventing burning due to leakage currents.

We are now using conduction paint on all new wood pins and hope it will protect them throughout the life of the poles and arms. We have observed that this paint has not greatly deteriorated after eight years of weathering in use on insulators for reducing radio interference.

How the insulators show up is another story—not yet fully explored.

Expulsion Tubes Reduce Line Outages

Double-circuit interruptions due to flashovers on two-circuit 110-kv. line eliminated — Single-circuit outages materially cut down — Tube life estimated at 54 years average — Insect nests increase maintenance

D. H. HATHEWAY and A. B. JONES, Boston Edison Co.

DECIDED improvement in the operating record of a 30-mile, double-circuit, 110-kv. transmission line of the Boston Edison Co. has been achieved as a result of the application of expulsion protector tubes to all insulator strings. Methods of patrol, of keeping operating records and of tube maintenance are of interest, together with the estimation of probable life of expulsion tubes.

Boston Edison operates a double-circuit 110-kv. transmission line which passes south of Boston from the Edgar station in Weymouth to Medway, a distance of 30.1 miles. From the Medway station the two circuits continue 16.5 miles on single-circuit towers, 2.1 miles of Edison and 14.4 miles of New England Power ownership, to the Millbury station of the New England Power Co. This article is primarily concerned with the double-circuit tower line (Fig. 1) from Weymouth to Medway, which is protected by expulsion tubes.

The circuits are carried on 211 double-circuit suspension or dead-end towers 85 and 100 ft. high, and three 275-ft. dead-end river-crossing towers.

The three No. 4/0 stranded conductors of each circuit are arranged vertically on either side of the tower (Fig. 2) with 12-ft. phase-to-phase spacing. A single ground wire ($\frac{7}{16}$-in. Siemens-Martin 7-strand steel) is carried on the peak of the towers with 13½ ft. spacing (10 ft. vertically) to the top phase wires (Fig. 3). There are no transpositions. The towers are located on a cleared right-of-way over low hills. Soil conditions vary from rocky hills to sandy marshes. Ground resistance of the individual towers varies from 15 to 1,000 ohms.

Horns and Rings Removed

Insulation consists of 10-in. suspension type insulators, eight units in suspension strings and ten units in strain strings. Originally one circuit was equipped with arcing horns on both line and ground ends of insulator strings, while the other circuit was equipped with horns at the ground ends and grading rings at the line ends of the insulator strings. No appreciable difference in performance was noted between the two forms of insulator protection, and when the expulsion tubes were installed the rings and horns were removed.

In the period from 1931 to 1933 many single-circuit and double-circuit outages of the Edgar-Walpole and Walpole-Millbury circuits were experienced during lightning storms. A careful analysis of these outages indicated the following defects in the line:

1. The single ground wire did not provide adequate shielding against direct strokes between towers.
2. The tower-footing resistances were too high to give good lightning protection.
3. The clearance between the ground wire and the top conductors at midspan was inadequate for direct strokes.
4. The line clearances to the tower were too small under severe wind conditions.

It was impracticable to install an

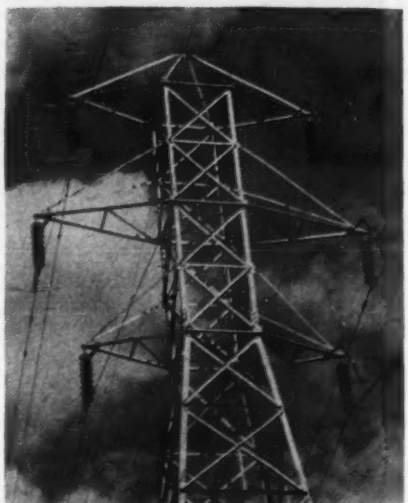


FIG. 2—Typical suspension tower showing gap installation and galvanized steel arcing protectors on conductors at crossings

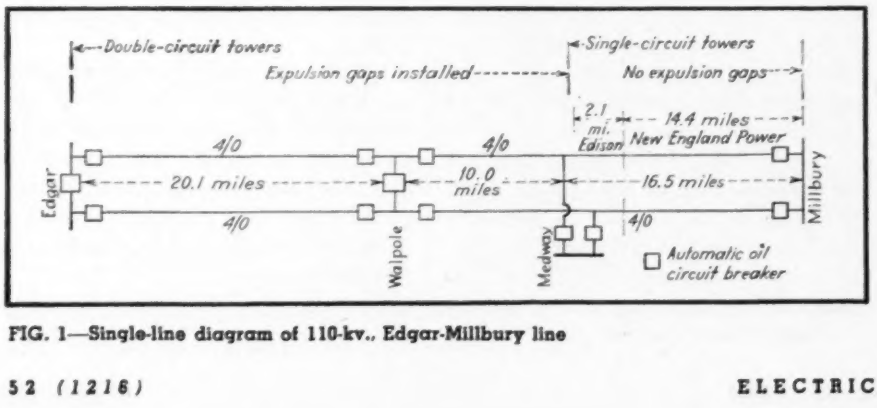


FIG. 1—Single-line diagram of 110-kv., Edgar-Millbury line

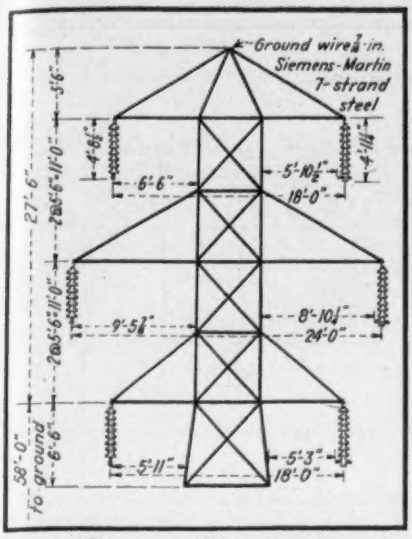


FIG. 3—Clearances for suspension string insulators on transmission tower.

additional ground wire and provide greater midspan clearances between the ground wires and the conductors both on account of the extensive structural alterations in the towers, and also because the operating conditions precluded taking the lines out of service for rebuilding.

Consideration was given to reducing tower-footing resistances by installing counterpoises at the base of each tower, but the improvement to be obtained from this item alone, due to the character of the line and nature of soil condition, did not appear to offer sufficient gains to warrant undertaking this work unless improvements could be also effected in the overhead ground wire arrangement.

During the process of investigating the various methods of improving the performance of the line, studies were made of several installations of protective expulsion tubes on lines similar in character to the Boston Edison line and careful attention was given to the operating records of these lines for several years.

Changes Made to Improve Conditions

As a consequence of the improved operation of the lines on which the expulsion tubes had been installed and the necessity for improving the lightning performance of the Edgar-Walpole-Millbury line at a reasonable cost without removing the line from service for an extended period, it was decided to equip all insulator strings on the 214 towers of the double-circuit line with protective expulsion tubes.

The expulsion tubes were installed during the spring and early summer of 1937. Some eight cases of gap or conductor damage were experienced during that summer, including an instance where a conductor "burn-down" occurred upon the occasion of the failure of one of these tubes.

The serious nature and the number of these troubles caused the Boston Edison Co. to stage a series of tests at the Edgar station as to the amount of short-circuit current and recovery voltages encountered, as well as high-voltage and current tests on the tubes themselves at the manufacturer's plant, in cooperation with the maker of the tubes. These tests indicated that the recovery-voltage rate was probably in excess of that on which the tube design was based, and as a result a four-gap tube with heavier side walls was recommended by the manufacturer.

Another series of tests on experimental models of redesigned four-gap tubes was conducted in the early part of 1938. These tests indicated that the new design would be satisfactory and it was decided to equip completely one circuit of the Edgar-Walpole line with the new type tube.

This installation was finished during the early part of the summer of 1938 and from then through 1939, one circuit of the Edgar-Walpole line was protected by the new type tubes. The other Edgar-Walpole and both Walpole-Medway circuits were still protected by the original tubes.

The operating record of the new type tubes during 1939 substantiated the results of the earlier tests, and in the spring of 1940 the circuits were

Table I—Characteristics of Insulator Strings and Horns before Tube Installation

No. of Units	Arcing Distance In.	60 Cycle Flashover Kv. Dry	60 Cycle Flashover Kv. Wet	Impulse Flashover Kv. 1½ x 40 ms. Wave Pos.	Impulse Flashover Kv. 1½ x 40 ms. Wave Neg.
8 Susp.	39¼	380	335	630	720
10 Strain	49¾	480	415	790	900

Expulsion tubes having the following impulse voltage discharge characteristics as recommended by the manufacturer were chosen to give the best over-all protection:

Impulse Flashover Kv. 1½ x 40 ms. Wave Pos.	Neg.
575	635

Table II—Operating Record of Edgar—Walpole—Medway—110-kv. Lines, Showing Outage Experience by Sections

Year	Edgar—Walpole Towers No. 1–No. 141–20.1 Miles, Double-Circuit, Protected: Single-Circuit Outages	Edgar—Walpole Towers No. 1–No. 141–20.1 Miles, Double-Circuit, Protected: Double-Circuit Outages	Walpole—Medway Towers No. 142–No. 214–10.0 Miles, Double-Circuit, Protected: Single-Circuit Outages	Walpole—Medway Towers No. 142–No. 214–10.0 Miles, Double-Circuit, Protected: Double-Circuit Outages	Medway—Millbury Towers No. 143–No. 1–16.5 Miles, Single-Circuit, Not Protected: Single-Circuit Outages	Medway—Millbury Towers No. 143–No. 1–16.5 Miles, Single-Circuit, Not Protected: Double-Circuit Outages
No Expulsion Tubes 1931	0	5	0	2		
No Expulsion Tubes 1932	0	2	3	0		
No Expulsion Tubes 1933	4	7	5	5		
No Expulsion Tubes 1934	0	3‡	3	0		
No Expulsion Tubes 1935	1	5	8	1		
No Expulsion Tubes 1936	6	9	6	0		
Total 1931–1936	11	31	25	8		
Average Per Year	1.83	5.17	4.16	1.33		
Old Type Tubes 1937	4	0	4	4		
Old & New Type Tubes 1938	1	2	5	0		
Old & New Type Tubes 1939	0	0	4	3		
Total 1937–1939	5	2	13	7		
Average Per Year	1.67	0.67	4.33	2.33		
New Type Expulsion Tubes 1940	0	0	3	2†		
New Type Expulsion Tubes 1941	0	1*	3	0		
New Type Expulsion Tubes 1942	0	0	3	0		
New Type Expulsion Tubes 1943	0	0	3	1*		
Total 1940–1943	0	1	12	3		
Average per Year	0	0.25	3.0	0.75		

* The outage of the second line was caused by improper relay action.

† The first double-line outage occurred on a clear day with no wind. Relay action and the oscillographic record indicated a two-phase-to-ground fault, one-phase on each line. No cause was ever found. The second double-line outage was a backup overload operation caused by delayed clearing of a fault on an interconnected system.

‡ In one of these cases the outage of the second line may possibly have been caused by failure of the potential supply from the bushing-type potential devices.

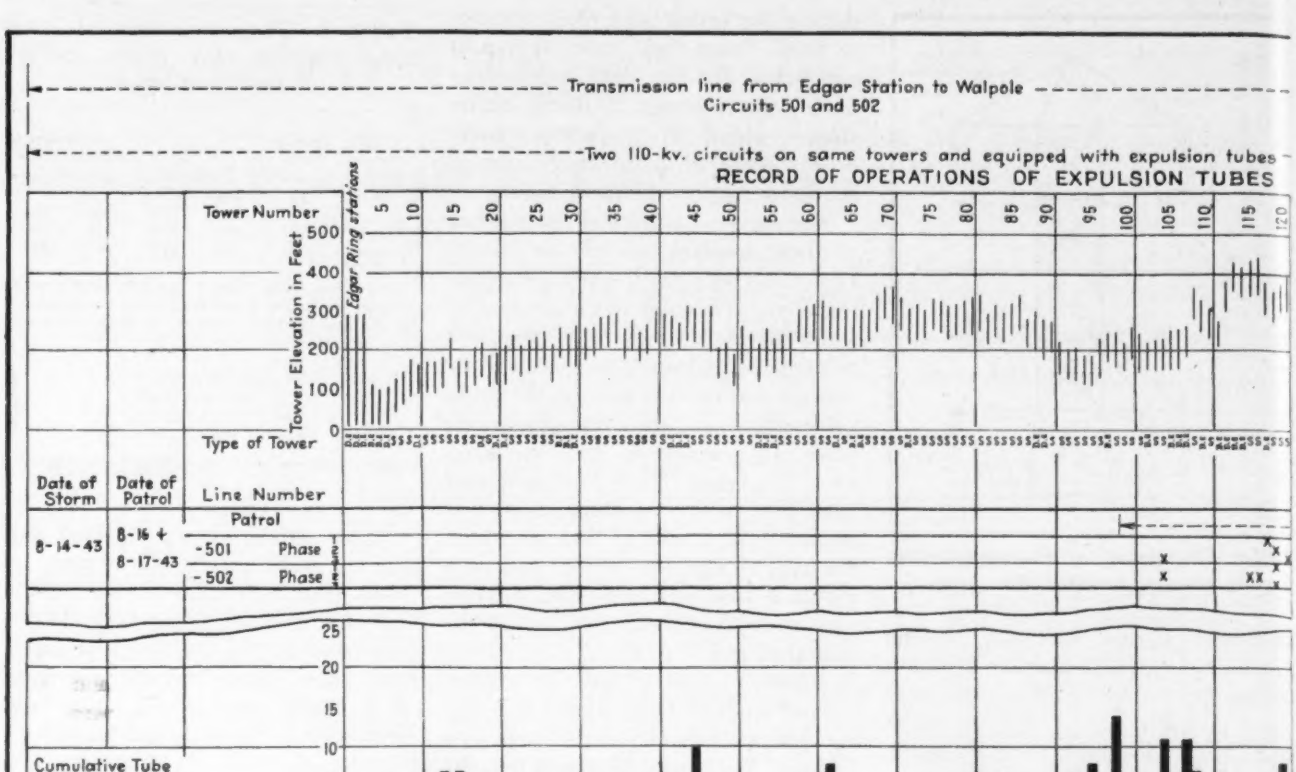


FIG. 4—Chart recording operations of expansion tubes on transmission line, including cumulative record of tube operations for each tower from 1937-1942; elevations of

completely equipped with new type tubes which have been in continuous service since.

Table II shows the improvement which was obtained in operating performance of the line.

Patrols and Operation Data

Complete record is kept of all station relay operations and other indications of abnormal conditions on the lines. Fig. 4 is a reproduction of the form used for this record. The lines are patroled after all relay operations and after each lightning storm affecting the area near the lines to determine the location, circuit and phase of each tube operation and to reset the targets as described below. The patrol is completed within two working days after a storm to preclude intervening storms from destroying data. Occasionally two or more lightning storms occur so close together that it is not possible to tell which tubes operated during a particular storm.

Operation Indicator

Each tube is equipped with a target consisting of a strap of phosphor bronze screwed to the side of one of the vents and bent to cover the opening. When the tube discharges the blast from the vent bends the target outward, thus indicating one or more tube operations since the last reset. The target is reset by bending the strap back over the vent with a switch stick. Because the targets indicate only the first operation after the previous reset, it is desirable to reset them as soon as possible after each storm. It is necessary for the patrolman to use field glasses to detect operated targets. Towers are climbed for close examination when defects of any kind are noted.

Probable Life of Tubes

Five years' experience is an insufficient basis upon which to predict with much accuracy the life of expulsion tubes. Tube life is influenced by the following factors:

1. Erosion. The bore ($\frac{3}{8}$ in. initially) of the fibre tube at the internal gaps is eroded to a larger diameter by the arc blast tearing off particles of fibre. This is normal destruction of the tube since the torn fibre and

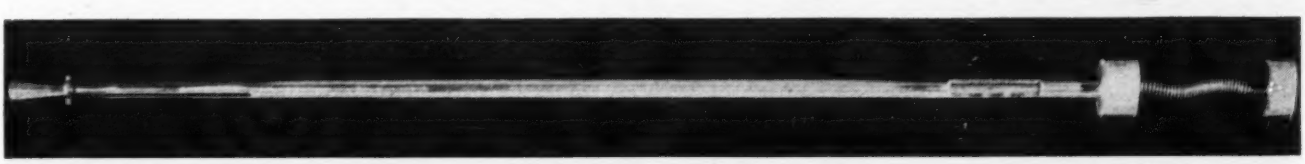


FIG. 5—Caliper for measuring tube erosion; this is calibrated in thousandths of an inch.

towers are above sea level; original chart is 32 in. x 26 in.; sample patrol record after a lightning storm is shown covering 16 satisfactory tube operations and no unsatisfactory operations.

turbulence in the gases give rise to the insulation recovery characteristics of the device. The manufacturer states that an erosion of $\frac{1}{16}$ in. of internal-bore diameter is the allowable limit for satisfactory operation. During the seven years of operation the 1,284 tubes of the complete installation operated 583 recorded times. It is probable that over 600 operations actually took place; 331 tubes operated once, 83 twice, 18 three times, and 8 four times. After three or more indicated operations on a given tube the tube is removed and the amount of erosion of the bore is measured with a special caliper (Fig. 5). A great variation is noted in the amount of erosion per operation. Erosion measurements of 16 tubes after 27 total operations indicated an average erosion of 0.0142 in. per operation. The allowable erosion of $\frac{1}{16}$ in. would thus provide an average life of 4.4 operations per tube. At this rate we would consume 23.6 tubes per year, and the average life would be 54 years.

2. Mischievous damage, particularly rifle fire. To date this has necessitated the replacement of two tubes.

3. Excessive lightning discharge current. The tubes are rated to withstand a maximum discharge of 5,600 amp. In a few instances the discharge currents apparently exceeded the capacity and the tubes were blown apart by excessive internal pressure.

4. Insects. During the past summer the first evidence of damage resulting from insects (probably wasps) laying eggs in the bore of a tube appeared. The deposit prevented proper drainage and ventilation of the tube and the accumulation of moisture resulted. This caused the fibre shells to swell and rupture the outer protective casing, exposing the fibre body to the weather and thereby introducing the possibility of surface flashover of the tube following breakdown of the external series gaps by a lightning discharge.

Tube Record

A record of tube operations, measurements of erosion and replacements has been found very helpful in preparing data on tube life, selecting units for erosion measurement and supervising general maintenance. Fig. 6 shows a sheet taken from this rec-

EXPULSION TUBE OPERATION RECORD

Original Installation May 5 To July 22 1937

Line No. 146-11-501 — Tower No. 78 — Type of Tower

Operating Record

Phase 1	Phase 2	Phase 3
AUG 11 1938 No. 420	New tubes of new type installed No. 417	No. 423
MAY 31 1939 Patrol - Target Tripped JUN 15 1939 Patrol - Target Tripped AUG 20 1939 Patrol - Target Tripped SEP 19 1939 Tube removed for erosion measurement Bore diam .386" Erosion .011" Tube returned to stock. New tube installed No. 878	MAY 31, 1939 Patrol - Target Tripped	AUG 19 1939 Tube removed Split Casing Wasp nest in 3rd gap. To be repaired New Tube installed No. 764

FIG. 6—Expulsion tube operating record, shown for each phase of one circuit on typical tower; original form is 10½ in. x 4⅛ in.

ord. By means of the entries, the entire history of a tube position is recorded together with the serial numbers of the tubes involved in each operation. The record of an individual tube can be traced to determine every event in its history.

Maintenance of Tubes

Protective painting of the outer casing is the chief maintenance required. The original tubes were painted with a clear glyptal varnish which had a relatively short life when exposed to sunlight. A red-pigmented glyptal enamel was used on tubes purchased subsequently. This finish appears to be lasting very well, as tubes recently examined were still well protected after three years of exposure. At least five years' life is predicted for this paint.

From the recent experience with insects, it may be necessary to devise a means of testing tubes in place for obstructions. Tubes which are stopped up must be removed and the obstructions blown out with compressed air to avoid the possibility of improper operation.

Summary

The installation of protective expulsion tubes on this double-circuit line has to date eliminated double-circuit outages due to line flashovers and has materially reduced the number of single-circuit outages.

Maintenance of tubes to date has been periodic painting on a five-year basis. Tubes damaged by retention of moisture within the bore as the result of stoppage by insect nests are being sent to the manufacturer for repair.

Routine testing of tubes in the line for obstructions appears to be necessary to prevent future damage from this cause. Plugged tubes will be removed from the line and blown out with compressed air.

•

Output in Canada

Central electric stations in Canada produced a total of 3,528,908,000 kw.-hr. in January, the greatest output in any January on record. The increase over January of last year was 9.5 percent, the total in that month having been 3,226,644,000 kw.-hr. Exports to the United States in January increased to 209,289,000 kw.-hr. from 203,579,000 kw.-hr. in January, 1943.

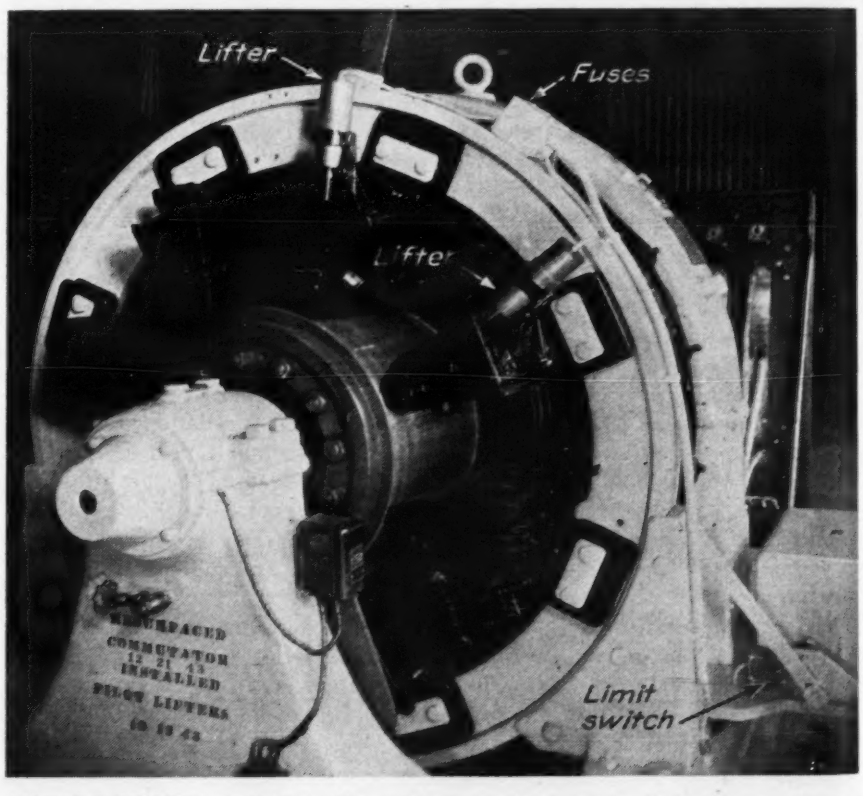
Pilot Brush Lifters Cut Commutator Wear

Pilot brushes lifted by solenoids after rotary converter has been started—Abrasive action and commutator grinding reduced—Life of main brushes increased

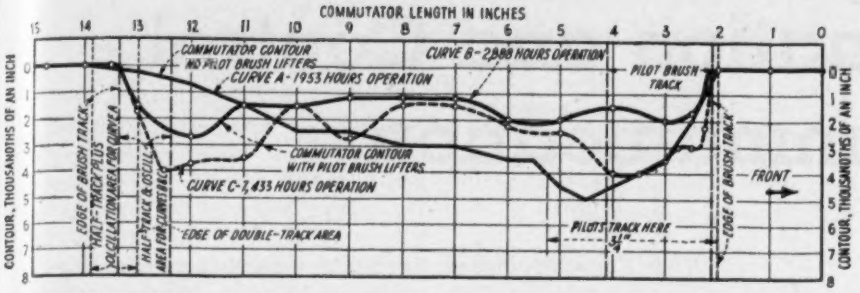
T. W. BUTTNER, Equipment Engineer
Columbus & Southern Ohio Electric Company, Columbus, Ohio

By devising means for lifting abrasive "pilot" brushes from the commutator of rotary converters after their starting function is completed, this company has increased the life of its converter brushes about 3½ times and lengthened the interval between commutator grinding operations nearly four times. The scheme employs solenoids to lift converter pilot brushes ⅛ in. from the commutator as soon as the machine is ready to assume load.

Pilot brushes—although they serve no useful purpose after the main d.c. brushes have been lowered and load is being delivered—have heretofore remained in contact with the commutator at all times. Starting duty to which they are subjected demands that they have high resistance and high contact drop. Highly abrasive



SOLENOID DEVICE on 1,000-kw., 600-v., 900-rpm rotary converter reduces wear on main d.c. brushes and commutator by raising abrasive high resistance pilot brush when not in use


COMMUTATOR LENGTH IN INCHES
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
CONTOUR, THOUSANDTHS OF AN INCH
COMMUTATOR CONTOUR NO PILOT BRUSH LIFTERS
CURVE A-1953 HOURS OPERATION
CURVE B-2,888 HOURS OPERATION
PILOT BRUSH TRACK
COMMUTATOR CONTOUR WITH PILOT BRUSH LIFTERS
CURVE C-7,433 HOURS OPERATION
EDGE OF BRUSH TRACK
HALF-TRACK PILOTS
HALF-TRACK & OSCILL. AREA FOR CURVE A
EDGE OF DOUBLE-TRACK AREA
PILOTS TRACK HERE
FRONT

CONTOUR CHARTS of comparable 500-kw. converter commutators show reduction in wear after installing pilot brush lifter. Curve A after 1,953 hr. without lifters. Curve B after 2,888 hr. and curve C after 7,433 hr. with brush lifter

materials are required to achieve this.

The resulting abrasive action of the harsh pilot brushes has been a factor contributing to generally short life of brushes and commutators on converter duty. A protective film is formed on the commutator under the low-resistance main brushes which acts to reduce any abrasive action that the main brushes may have. The abrasive action of the pilot brushes prohibits the formation of this protective film by the main brushes in the pilot brush track. The pilot brush track soon becomes roughened, and then the overlapping of brushes combined with the oscillation of the rotor progressively spreads this roughened area across the commutator face, all the while cutting deeper beneath the pilot brushes. Rapid brush deterioration and serious wearing of the commutator surface results.

By using a solenoid device to lift the pilot brushes from the commutator as soon as the starting cycle is finished, the abrasive action of the pilot brushes is limited to a 45-second interval on starting and to a short period when shutting down.

A.C. and D.C. Solenoids

Two solenoid schemes are in use on converters. The more common uses an a.c. type solenoid. Two of these, with their coils in parallel, are energized from the 440-v. a.c. supply rings of the converter through a series-limit switch in the circuit actuated by motion of the main d.c. brushes. As the main brushes drop on the commutator, the limit switch energizes the solenoids to pick up the pilot brushes. The solenoids remain energized as long as the machine is running or until a.c. supply is cut off. Then the pilot brushes drop onto the commutator ready to start the machine again.

D.C. solenoids are also used. Voltage for these solenoids is 600-v. d.c. taken from the machine through auxiliary contacts on the main machine contactor. Thus as the contactor is closed, connecting the converter to the d.c. bus, solenoids lift the pilot brushes. Again the solenoids remain energized as long as the machine is on the d.c. bus.

There are 14 converters on company system ranging in size from 500 to 1,800 kva. Shortly all these machines will be equipped with pilot brush lifters. Some measure of the improvement in brush and commutator life expected is given by the case of two comparable machines. One without the lifting device required commutator grinding at 1,953 hours running; the other equipped with the brush lifter operated for 7,433 hours with less than 60 percent of the commutator copper loss of the first machine. The protective film over the commutator surface was in excellent condition, indicating 8,000 more hours running before commutator grinding. Previous average brush life of 2,500 hours increased to 9,200 hours with the installation of the pilot brush lifting device.

Flashovers Eliminated

Formerly pilot brushes and the main brushes in the pilot brush track caused 90 percent of all flashovers on our system. Due to the lack of the protective film in the pilot brush track resulting in lower contact voltage drop between these brush faces and the commutator surface, these brushes carried more than their share of the machine load. When a heavy load was thrown on a machine, intense arcing occurred at these brushes, ionizing the immediate surrounding air sufficiently that a flashover arc was established from one brush arm to the next. The arc to grounded frame was secondary and incidental. Arcs between brush arms caused almost all the damage. Lifting the pilot brushes from the commutator during running time permits build-up of protective film over the whole commutator brush area, dividing load equally to all main brushes, thus eliminating this cause of flashover.

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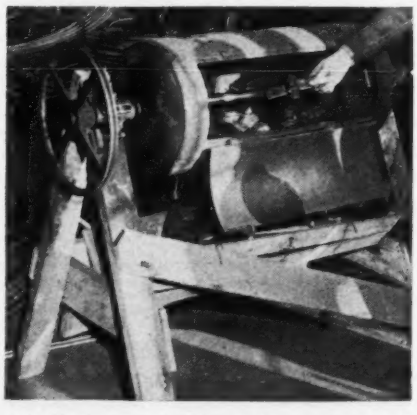
Homemade Cleaner Salvages Parts

Not alone the necessity of conserving, reconditioning and rehabilitating to conserve critical materials, but plain good business as well, has led the Washington Water Power Co., Spokane, to study warehousing problems with an eye to new methods and economy. Cleaning and reconditioning of metal parts, hardware, etc., is quickly and effectively accomplished by the simple drum-cleaner illustrated. It is made from a section of old 30-gal. hot water tank with hinged cover. A shaft through the center and pulley permit it to be revolved by a shop utility motor.

Cleaning takes place by churning of the metal parts. The batch shown in the photograph happens to be carbon arc holders for flaming arc street lights.



SECTION of old 30-gal. hot water tank makes excellent cleaner for metal parts

Load Designation and Control Without Communication

New England Power System's routine provides for operation without dispatching supervision for 48-hour minimum period — Recent ten-hour rest without incident

CLEMENT P. COREY, Chief System Dispatcher, New England Power System, Millbury, Mass.

THE PLAN for No Communication (N. C. Schedules) was brought about by the need of a means by which the New England Power System could be operated (in so far as load designation and control were concerned) without dispatching supervision for a period of at least 48 hours, during which time mobile dispatching units could be organized and operating control established in the field. While the need for such a plan became more urgent as a result of the war, and the final development of the plan was strictly a war measure, its use is no less valuable in peace and will be continued as a regular operating procedure of the system.

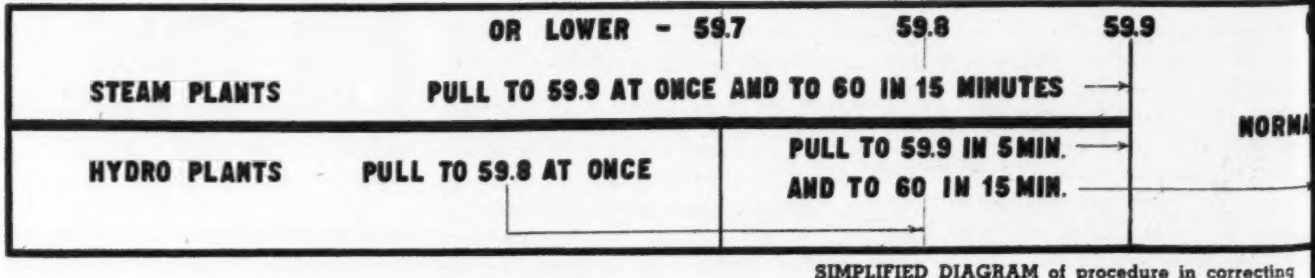
The complete N. C. Schedule was the answer to one question, "How would the system have been set up if the worst possible condition of air raid over it was known in advance?" In its final form, the allocation of loads to steam and hydro plants was predicated on numerous factors involving the loss of power houses, substations and transmission lines, coupled with the loss of all communication. The development of the final plan took months of load and capacity study and the shuffling and reshuffling of plant loading to fit best into the over-all picture of the system as a target, tempered in no small degree to meet as well the need for assistance of our neighboring systems should they be the target. Briefly, an attempt was made to prepare against the complete loss of one plant, and through a multiple of losses until *all* were unavailable, designing the plan so that even one plant regardless of its size, if available, would in the end serve a *load* if a load was *still* there. In laying the foundation of the plan, it was considered that *anything* could happen. If and when it did, the plan *must* and *would* find the system prepared to operate as a unit or a multiple of units without any communication whatever, either between the dispatcher and the stations or between the stations themselves.

Frequency Control Fundamental

Instructions for the operation of lines and feeders without immediate dispatching control had been successfully in force on the system for many years and were a matter of coordinating *action* with *time*. Load designation and control without immediate dispatching control (as under the N. C. Schedules) involved coordinating *action* with *frequency indication* and *time*.

Before the New England Power System introduced its plan for (N. C. Schedules) load designation and control, it was necessary to develop a "yardstick" by which all stations of the system, as well as its interconnected neighbor plants, could gauge the amount of load to be carried during the periods of distress. As a result of this requirement, System Frequency-Load Control Rules were designed. They are summarized graphically in the accompanying illustrations.

Under these rules steam plants go into action for speed correction above or below 60.1 or 59.9 cycles and effect an immediate correction to 59.9 or 60.1 cycles, utilizing the full ability of the plant for this purpose. Such a procedure insures the system against all-hydro correction, which, while more effective, may in many cases load hydro plants so quickly as to hide from the relatively slow steam the fact that the system is in distress. If quick hydro were permitted to be utilized on the first signs of trouble (as indicated by the frequency) and the trouble proved to be of major



SIMPLIFIED DIAGRAM of procedure in correcting

proportions, it is likely that the steam might be found quite unprepared for heavy increases or decreases. The "yardstick" demanded prompt utilization of steam plants on the first sign of trouble, as well as "stop-loss" orders for the hydro at 60.3 cycles or higher and 59.7 cycles or lower, whereby the hydro capacity would effect instant correction beyond these bands by bringing the frequency up to 59.8 cycles, or down to 60.2 cycles as the case might be, thus insuring absolute control over the emergency at hand. Time delay was then introduced in so far as further hydro participation was concerned in order that the steam be given sufficient time to follow through, and at the same time eliminate overshooting 60 cycles as is the case when a great number of plants respond to an emergency.

The prime object of the System Frequency-Load Control Rules is to handle successfully the emergency at hand and still keep the system from "horsing." Plants assisting in bringing the frequency under control in accordance with the foregoing instructions attempt to resume scheduled load after fifteen minutes. If unfavorable frequency reaction results, such plants will return the frequency to 60 cycles and try again in one hour; failing in this, they repeat the attempt every two hours.

These rules are in force at all times whether or not communication is available, thereby insuring immediate action. When communication is available, the dispatcher may concentrate his attention on the larger capacities and bring the frequency under control without reference to time lag.

N. C. Schedules

Each station is provided with its N. C. Schedule, which is divided into three parts: N. C. A—Weekdays; N.C. B—Saturdays; N.C. C—Sundays. These schedules show the hourly load assigned to it under the N. C. set-up.

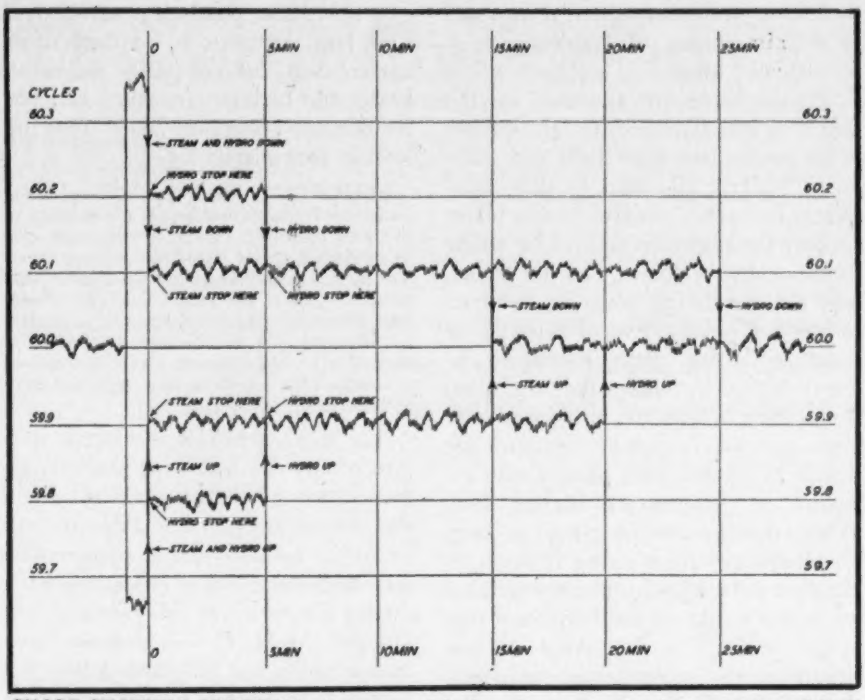


CHART SHOWING PROGRAM of steam and hydro plant operation for correction of high or low frequency

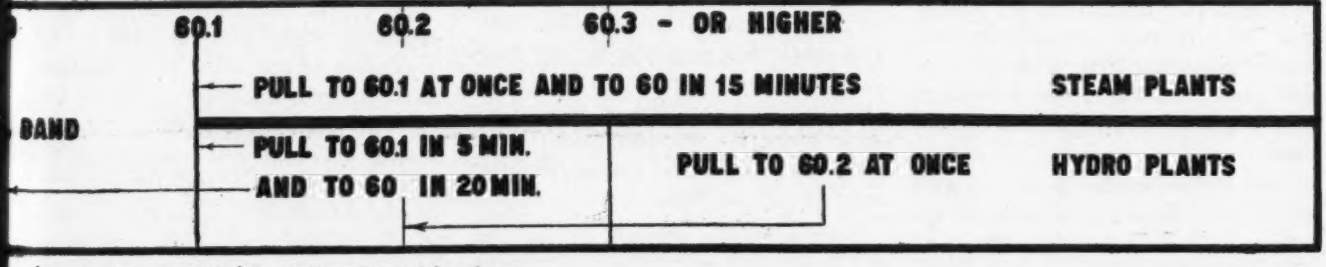
The total system load forecasted under the N. C. Schedule is based on an average hourly estimate which is self-correcting due to the method of allocating individual plant loadings by area demands as well as adjustments to be made by the operator for overcast or dark days, and with still further adjustments made for evening darkness.

Variations Quickly Noted

Since the method of assigning loads is based on area demands, such area demands are known and seen by the operators in those areas, and variation in these demands from any cause is quickly noted. The manner in which these area demands are allocated to the plant or plants within the area is determined by the degree of protection desired as related to the system as a whole, and depending upon the time of day, the reserves of steam and hydro, the loading of the system's transmission lines and the probability that this area is the target. A final N. C. Schedule was drawn in which the plants in the area considered would, in one period, carry loads equal to the area demands; in another period carry loads less or greater than the area demand, but in all cases operated primarily to protect its area controlling the amounts by tie line schedules to or from the system. In *all cases* the allocation of plant loadings are made to minimize the effects of a raid on the entire system, thereby making it possible to utilize every resource of the system to assist, in so far as capacity is concerned, areas which are in trouble.

Flexibility of N. C. Plan

As will be noted, the plan is pointed to operate the system as an interconnected unit, yet at the same time



frequency as mounted in stations for quick reference

is flexible to the extent that it provides a definite means of operating as a multiple of units.

Hydro loads are allocated on the basis of less than normal river flows with ponds less than full, and sufficient load is allocated to one automatic frequency control hydro plant, to keep the system in control for either light or heavy loads. Further to assist the regulating plant, as well as protecting against loss of capacity or load, a hydro plant scheduled to carry 40,000 kw. under the N. C. plan would be run with the unit gates wide open and the frequency regulator set for 60.05 cycles. This plant would respond to frequencies higher than 60.05, thereby dropping load to keep the frequency from rising further. In another case, a hydro plant scheduled to motor would set the frequency regulator at 59.95 and responds to low frequency to prevent the frequency from falling further. For average day loads the system has available under automatic regulation a capacity of 100,000 kw. up and 50,000 kw. down in the normal regulation band of 1/20 high to 1/20 low, and in addition, during various periods, 40,000 kw. up and 40,000 kw. down, effective for frequencies in excess of 60.05 or 59.95.

Load Assignments

The amount of load assigned to the hydro plants is determined by the over-all system condition, considering these plants as units of capacity to be freely used for emergency service, but restricting their long-time use to values of firm power which can be reasonably maintained under the most adverse condition of stream flow. The use of storage reserves under the N. C. Schedules is outlined for the guidance of the hydro plant superintendents and they are authorized to utilize storage reserves to meet any deficiency in natural river flows.

Master copies of the complete N. C. Schedule for all plants, containing more than 60 pages, are in the possession of division superintendents, thereby providing them with the complete picture of the system as well as the part plants in their jurisdiction are playing.

Each station is also provided with specific instructions relating to its operation if N. C. Schedules cannot be met. These instructions include floodgate operation, pondage control, river time lags, corrections for dark days, corrections for evening darkness, boiler and turbine operation, etc. The instructions conclude with the following paragraph:

> REMEMBER! When you are operating under an N. C. Schedule, all other units of the New England Power System may also be operating under the same circumstances. An N. C. Schedule is no guarantee that you will receive the scheduled load; therefore, *do not attempt* to discharge your *duty* by following any specific rule to the exclusion of all others, but do exercise *caution, prudence* and *action* in line with the complete instructions.

The N. C. Schedule is effective at 5 p.m. of any day following loss of communication on that day. All plants on the system are given a *forecast* (not an N. C.) for 24 hours in advance at 5 p.m. each day. Loss of communication during the period of this *forecast* does not put the N. C. Schedule in force immediately, but all plants follow the *forecast* tempered by System Frequency-Load Control Rules if necessary until the *forecast* runs out, after which time all plants shift to the N. C. Schedule. For weekdays the full hydro and steam capacity is utilized, and this may necessitate the adding of boilers and turbines if the N. C. is placed in force during hydro periods. If river flows are in excess of the generation assigned to hydro plants, the difference will be spilled, since the primary purpose of the N. C. Schedule is not economy operation but operation to protect *New England service* during and following air raids or other disasters when the system *must* be kept under control at all costs.

Participants

Twenty-nine plants and interconnected companies involving a load of upward of 700,000 kw. participate in the N. C. Schedules and *all* have operated under them. The N. C. Schedules have been in force since May 1, 1942. Two system-wide tests have been conducted. The first test was on July 2, 1942, in which the system ran for eight hours, and the most recent test on October 22, 1943, in which the system ran ten hours without a load control order being issued by the Millbury system dispatcher. In both cases the operators throughout the system were given no warning prior to the test, but received the following order from the dispatcher:

> Starting at this moment, for test purposes, you will consider you have lost communication with the dispatcher so far as load control is concerned. You will proceed in accordance with No Communication (N. C.) Instructions dated May 1, 1942.

This order set into motion the *N. C. Schedules*. Both tests were successful. The October 22 test, however, was the more interesting, because it demonstrated the alertness of the system personnel and left no doubt that the procedure was thoroughly understood. During this test the system plants handled a noon-time drop of 175,000 kw. and an increase of a like amount at 1 p.m. For fifteen minutes during the noon hour the hydro plant to which the automatic frequency control was assigned went to motor, and the frequency rose 0.1 of a cycle, but this brought into play the Frequency Load-Control Rules and three steam plants dropped 13,000 kw. and two hydro plants dropped 25,000 kw., this bringing the frequency to 60 cycles and back under automatic regulator control.

It was inspiring to see a system kept under good control without a word from the dispatcher—and, most important, the load was being carried the *best* way for the protection of service, air raid or hurricane notwithstanding.

The N. C. Schedules represent the "ace in the hole" if communication fails. The New England Power System has here a very valuable tool—and the system knows how to use it.

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Sees Post-War Increase in Freezing of Foods

Tremendous expansion in the number and quantity of frozen foods after the war was forecast by Donald K. Tressler, manager of General Electric Co.'s Consumer's Institute, Bridgeport, Conn., in an address at thé University of Maine's annual Farm and Home Week.

"The quality of frozen foods produced has been very high and, consequently, the products are in great demand." Explaining the basis for his prediction of increased food freezing, he said large numbers of small and medium sized home freezing cabinets would be available at moderate prices and larger ones for retail food distributors; the number of kinds of frozen foods offered would be expanded greatly.

Selection of Thermal Overload Motor Protection

Best performance of motor in the temperature conditions of its application can be obtained by attention to characteristics of thermal overload relay protecting it

C. W. KUHN, Cutler-Hammer, Inc., Milwaukee, Wis.*

FREQUENTLY the selection of thermal overload relay protection for a.c. motors is not given the consideration it merits. For good economy motors should be purchased and applied to obtain a maximum usable horsepower for a given investment. This usable horsepower is finally determined by the protection selected for the motor.

The capacity of an a.c. motor and particularly the squirrel-cage type is limited by the allowable temperature of motor insulation. Therefore, the motor can have a much greater temperature rise and can operate at higher horsepower in low than in high ambient temperatures. Consequently, the size of the motor, for a given application, is determined in part by the maximum ambient temperature in which it will operate.

Fig. 1 shows ampere input curves for two motors as a function of ambient temperature. These curves demonstrate the possible increased current input of motors at normal and low ambient temperatures as compared to higher. The thermal overload relay permits using this increased motor capacity at usual and low ambient temperatures. Likewise, the motor, when subjected to heavy overload, has capacity for operating for longer periods of time at low ambients. The thermal relay permits such increased time of operation at these heavy overloads as shown by the curves of Fig. 2.

The selection of thermal protection for motors is a simple matter. Control manufacturers publish tables showing the overload rating based on full load motor current. The maximum rating is normally limited to 125 percent of full load motor current. This permits using the 115 percent service factor which is provided in standard motors.

Types of Relays

There are two types of thermal overload relays regularly used in industrial control, bimetal and solder film. The first uses a strip of bimetal to cause operation of the contacts. The movement of the bimetal is controlled by a heater coil which is connected in the motor circuit.

The solder film type has a metal rod held in a tube by solder. When the solder film melts, the rod can move in the tube. A heater coil surrounding the tube is connected in the motor circuit.

The results obtained with thermal overload relay protection depend on the design of the relay and its application. One major consideration in design is tripping temperature. This should approximate the maximum temperature at which the motor insulation is to be protected. For standard motors this value is 100 deg. C.

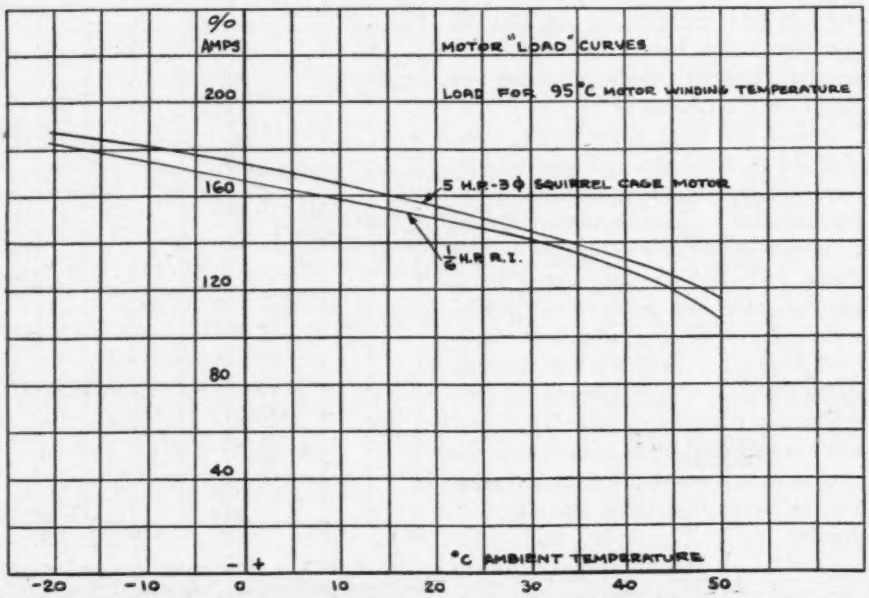


FIG 1—Motor load (ampere input curves for 95 deg. C winding temperature show how load may be increased as ambient temperature drops)

*Supervisory Engineer, Development Department.

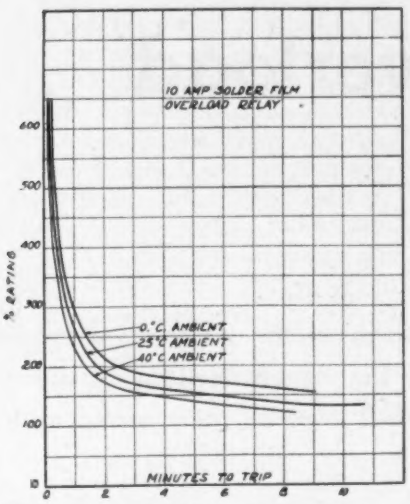


FIG. 2—Tripping-time characteristics of 10-amp. solder film overload relay at different ambient temperatures

With such a tripping temperature the relay will be affected by ambient temperature about the same as the motor. This is illustrated by curves of Figs. 3 and 4. These curves show that fixed tripping value (as illustrated by the magnetic overload relay and as would obtain with the so-called "compensated" thermal overload relay) would trip the motor off the line long before it got very warm in a low ambient temperature and before it developed its maximum safe horsepower.

Tripping Time

Another design consideration is tripping time as a function of current. This must be such as to take the motor off the line before it reaches a dangerous temperature. Again an increased tripping time is indicated for lower ambient temperatures to conform to motor capacity. This is obtained in the normal thermal overload relay as shown by the curves of Fig. 5.

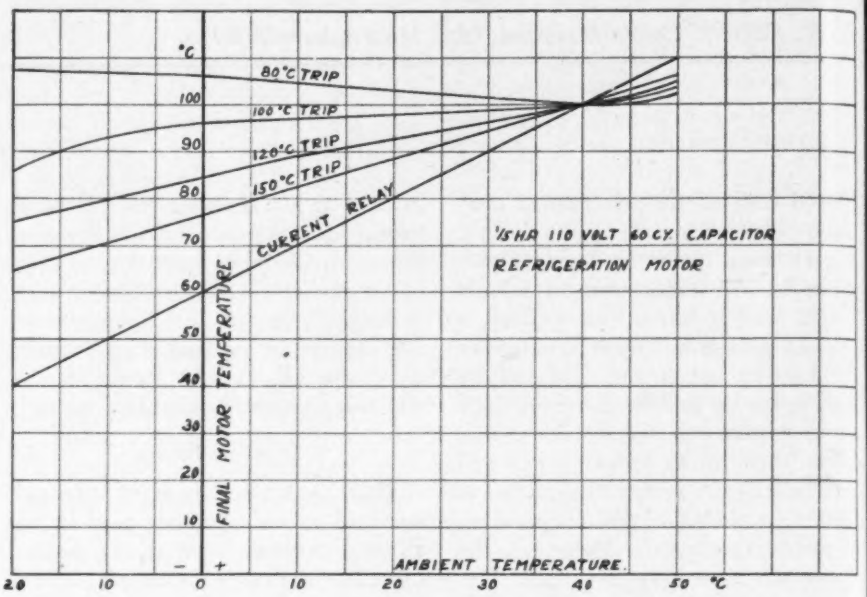
One of the most important considerations is accuracy of tripping current calibration. Many factors affect this accuracy. Some manufacturing variation must be anticipated in the heater coil. The resistance wire from which heaters are made is subject to a variation of plus or minus five percent. This alone causes a variation of approximately plus or minus 2½ percent in the tripping current. The heaters are also subject to some variation in dimensions so that the total variation is more than plus or minus 3 percent.

Further variation occurs due to changes in tripping temperature. This latter factor can be largely eliminated by using a solder film of a eutectic alloy which has a definite melting point like a pure metal or ice. Tripping temperature of the bimetal relay is controlled by factory adjustment.

The relation of the heater and thermal element is likewise subject to some manufacturing variation. Variation in tripping current due to this cause can be kept to a minimum when the heater coil and thermal element have a relation of concentric cylinders. Obviously, if the heater coil is closer to the thermal element on one side, it will be further from it on the other which reduces possible variations.

The Underwriters Laboratories require that thermal overload relays be rated so that they will trip at rated current in a 40 deg. C ambient. The assigned rating is, therefore, such that manufacturing variation will cause the relay to trip below its rating. In practice it is generally considered that the assigned rating is subject to a variation of plus "0" and minus 10 percent.

Thermal overload relays can be divided into two classes, with and without current adjustment. If properly used, current adjustment permits obtaining the maximum horsepower from a given installation. With cur-



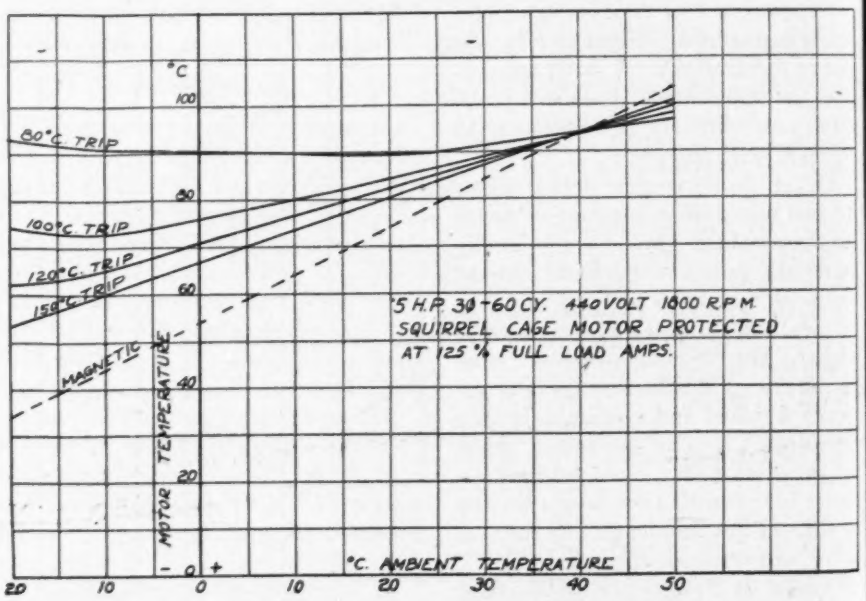


FIG. 3. FIG. 4—Automatic compensation of thermal overload relay for changes in ambient temperature. Above: 1/5-h.p. single phase, 110-v., capacitor motor protected for 100 deg. C in 40 deg. ambient; below, 5-h.p., three-phase, 440-v., 1,800 rpm. squirrel-cage motor protected to 125 percent full load amperes

rent adjustment the relay can be set to trip at the maximum permissible loading (usually 125 percent full load motor current).

It might at first seem that we could also compensate for manufacturing variations in tripping current. This, however, is rather difficult as the actual "ultimate" tripping current can only be determined by test and careful analysis of conditions. Such a test can be made by determining two current values, one at which the relay will trip and the other at which it will not trip. A test for an hour or longer is necessary to determine a current at which the relay will hold without tripping. It is necessary that the relay be tested exactly as it is to be used, i.e., in the starter carrying the load current and operating at normal voltage. From these tests and proper consideration of ambient temperature we can determine the actual minimum tripping value of the relay. Obviously all of this testing is not practical and the best general solution is to adjust the relay to the maximum permissible "indicated" tripping value.

There is some hazard in the use of a thermal overload relay with current adjustment. If the relay trips, the user may adjust it to higher values. If the relay is set to a tripping current beyond the safe value for the motor, it defeats its purpose of "safe motor protection."

Non-Adjustable Relay

If the relay is adjusted to lower than the maximum safe capacity of the motor, such adjustment is of no value and only leads to unnecessary tripping and loss of time. There is, therefore, a preference among some users for a non-adjustable relay which cannot readily be tampered with by the operator. Unfortunately, we cannot have an infinite number of heater coils for a non-adjustable relay. The steps between heater coils should be small and it is good practice to have increments of not more than 10 percent. Obviously, if we determine the maximum safe capacity of the motor and must select heater coils which have intervals of ten percent between ratings, we may be forced to sacrifice some motor capacity.

In applying thermal overload protection it is highly desirable that the control and motor be located in the same ambient temperature. Fortunately, this is the usual condition, and we can utilize the motor to its maximum capacity with adequate protection (see curves of Fig. 5).

If it is necessary to locate the control in some other ambient temperature than the motor, careful consideration must be given to the selection of the thermal overload protection. For instance, if the motor is outdoors and the control inside, the control will generally be at the same temperature as the motor in warm weather and at higher temperature in cold weather. This is not a serious matter as we then obtain adequate motor protection. If the motor is in a warmer location than the control, it would be necessary to select a lower rating of heater coil to obtain proper protection. If the control were mounted outdoors and the motor inside, the motor temperature might be maintained at 70 deg. F in cold weather, whereas the control at an ambient temperature of 0 deg. F would require a very substantial increase in tripping current. Such installations should be avoided.

Thermal overload relays seldom receive any attention from the time the control is installed until some accident occurs. They do not require any particular maintenance but should be inspected periodically. This inspection should consist of determining that the contacts are in good condition, that the terminals are tight and that the relay is not covered with a coating of dust and dirt. It is well to trip the relay at least once a year to insure that it is in operating condition. This tripping can be done with a special test equipment either to pass an overload current through the normal heater coils or to heat the thermal element by a special shunt heater. It sometimes happens that the relay contacts are welded together because of a "short" in the control circuit. This may happen if the control circuit is protected by large size fuses or circuit breakers. Such a welding of contacts makes it impossible for the relay to protect the motor.

In conclusion we again emphasize that thermal overload relay protection of a.c. motors determines the usable horsepower of a motor. Its selection should, therefore, be given careful attention. Selection of the proper rating of thermal overload relay heaters is readily determined from the Control Manufacturers' published tables.

In applying this protection, it is desirable that the control and motor be located so that both are subjected to the same ambient temperature. If it is necessary to have the control in a different ambient temperature from the motor, special consideration must be given to the selection of the thermal overload protection. Applications with the relay subjected to lower ambients than the motor should be avoided, particularly if the temperatures range widely. It is important that thermal overload relays be properly maintained. They should be tripped at intervals to insure that they are in good mechanical operating condition.

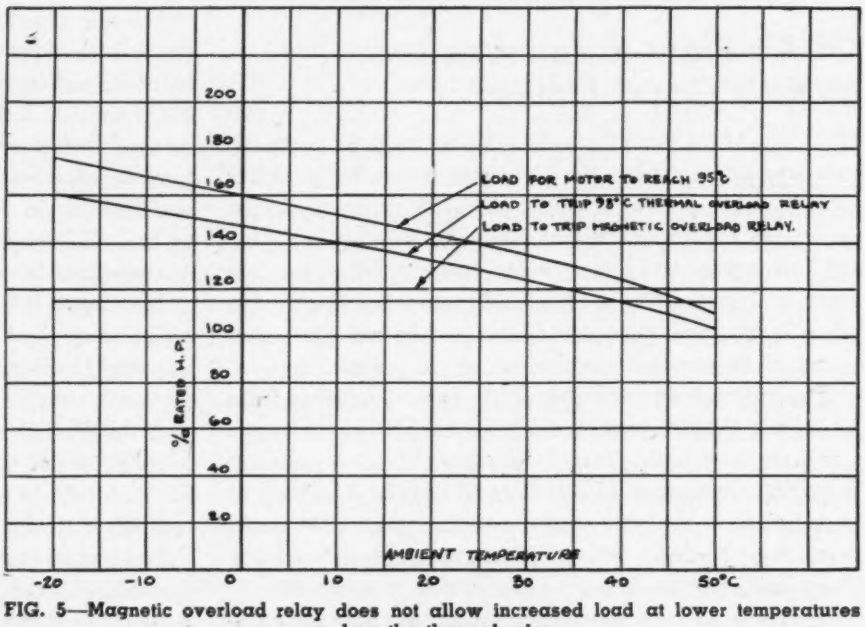


FIG. 5—Magnetic overload relay does not allow increased load at lower temperatures as does the thermal relay

Editorials

S. B. WILLIAMS, *Editor*

Business or Political Methods for TVA?

TVA IS A BUSINESS. It's a big business backed up by $700 million of investment and if it is to function efficently and effectively its management must have the same degree of flexibility that other big business has. To enclose its operations in restrictions as to management of its money, its employees or its operating procedures is to hamstring the undertaking.

The Senate is to be applauded for its insistence that creatures of its own making should live within the law, but the legal indiscretions of TVA which have just been brought to the attention of the upper house might be sound professionally and, if so, should not be too severely criticised.

The effort to bring politics into TVA through Senate approval of employees in certain wage brackets is the worst of all the proposals. There must be no remote control of operations such as there would be if something other than ability was the criterion for employment. There can be no division of authority or allegiance if a project is to be run in a business-like manner.

OPA's Right to Intervene in Rate Cases Limited

OUT ON ALL COUNTS is the OPA in its fight to substitute war price stabilization for state authority in utility rate regulation. Two months ago the Supreme Court denied in the Davies Warehouse case any authority to OPA over rates determined under state regulation and this week it went further in the Washington Gas Light case when it ruled that OPA could intervene in rate cases only so far as regulatory commissions would permit.

The original act removed utility rate regulation from Economic Stabilization but after considerable pressure Congress threw OPA a sop in the form of an amendment requiring notification of increases 30 days in advance and permission on the part of the company that OPA could intervene. Nothing was said, however, about commissions being required to give permission to intervene.

That was all OPA needed, however, to take the initiative. Not only did it intervene, but it attempted to stop the operation of automatic rate adjustment claims which had commission approval, to control changes in rate proceedings and to contest commission decisions.

Virtually the same show with the same actors is now being put on before the same commission against the rates of Potomac Electric Power, with the exception that OPA is not officially represented, merely lending its star legal performer to the government intervenors. It's like trying to catch a greased pig.

However, the industry located in states having regulation now has OPA off its neck and can feel encouraged, as one man put it ,that it can once more win a rate decision before the Supreme Court.

Depreciation Problem First a Matter of Policy

THROUGH THE 1943 REPORT of its committee on depreciation, the National Association of Railroad and Utilities Commissioners has provided the most absorbing topic of the day in top utility circles.

The points at issue are not so much matters of accountancy as of policy and until they can be decided at that level the accounting technicians can do little to clarify what has always been a moot subject.

Reconstruction of depreciation reserves, the so called retroactive requirement, is the most serious point because if carried out abruptly it can destroy the credit position of many utilities and gravely harm that of a much larger number. The committee that prepared the report would deny that it ever intended to apply the retroactive feature in a punitive manner and it is highly doubtful if the state commissions would accept anything beyond a corrective measure applied in such a way as to strengthen rather than weaken the financial position of the utility industry.

The second point at issue is the method of arriving at a reasonable reserve, straight line or observed. As we listen to both sides we come to the conclusion that the difficulty lies not so much in the method employed as in what the reserve is for. Is it for the purpose of reducing the owners' investment concurrently with use, or is it for the purpose of providing for wear and tear beyond ordinary maintenance in order that the customer might continue to be well served and that the owners may eventually be compensated for the property that has been used up?

Here again it is a matter of management and regulation policy that must be settled after which the method of arriving at the reserve or the amount of the reserve will be much simpler to adjust.

A third point, which is closely allied to the second, is whether or not original cost can be depreciated in arriving at a rate base. With reproduction new it is possible to apply a straight line theoretical depreciation to an estimated cost to arrive at a present value. But with original cost present value is everything on the books that can honestly be demonstrated to be used and useful in supply-

ing service. That the reserves may be borrowed on to finance new plant doesn't mean that the company is earning a return twice, because it must pay interest to the fund just the same as though the money were borrowed outside the company.

If the reserve is to be used to reduce the owners' investment in determining the rate base then it should be paid out to the owners concurrently with its rate base application, but where that has been done in the past with a resultant meager reserve the report now suggests that the reserve be returned by the owners. Regulation must see that it can't have its cake and eat it too.

As we stated in the beginning, these disagreements are matters of policy which must be thrashed out between management and regulation. It is unfortunate that the utility industry, and even the electric utility industry within itself, is not of one mind. It is equally unfortunate that utility management and commissioners have not been able more often to discuss this and other regulatory matters in an atmosphere of confidence and respect. If their minds were not closed, both sides might profit by it.

Co-op Association Elects New Officers

AFTER A YEAR of the Ellis-Tate combination members of the National Rural Electric Co-operatives Association showed at the second annual convention held in Chicago last month that they want no part of the political web in which they were being entangled. The old officers have been dispossessed and a new set who are closer to the rural electric problem than to the ballot box are in power.

The old gang however used the NRECA convention again as a rabble-rousing political rally with the private power industry posed as the big bad wolf as lying in wait for little co-ops. There is nothing constructive in such a program, nothing that will help any co-op to get along better.

This year the private companies were accused of controlling the Office of War Utilities to the extent that they were given preference in the allocation of materials for rural lines. There is hardly a week goes by but what we hear the same complaint in reverse from the power companies. All of which seems to indicate that OWU continues to be as unbiased as Director Krug said it would be.

If the new officers of NRECA wish to be truly helpful to the co-ops they might try to see how they can best work with the power companies. They may find that the "power wolves" were not all as bad as painted and that they can be pretty helpful.

The new officers might also do their best to keep the movement within the bounds set up for it in the REA act, namely the extension of service to unserved areas. The rural electric co-ops by keeping in their own yard may escape some of the pitfalls that consumer co-ops are digging for themselves. By doing so they can be of maximum service to the unserved farmers of this country.

Lend-lease of Engineering School Equipment at Home

A PROPOSAL before Congress would finance to a certain extent the return of service men to college to complete their education. These men in their present training courses have had to apply themselves with the utmost diligence to their studies. They will be impatient with long, drawn-out courses or with courses without specific objectives. They will expect more "applied" courses and may even ask for accelerated programs to hasten their graduation.

Members of the staff have had to learn to present material more effectively. The lecture system has given way largely to recitation courses. Visual education with shop visits and demonstrations and the use of models and moving pictures, have proven very much worth while.

If the best of these experiences, together with curricular changes to meet developments in the several branches of engineering, are to be used to best advantage in post-war college programs, the engineering schools must have more modern equipment. Since the government will have available after the war large surpluses of the latest designs of machinery for which outlets that will not interfere with regular production will be wanted, should not these engineering schools that have contributed so liberally in both equipment and staff to war training and war research be given a chance to secure some of this surplus equipment in order to bring their shops and laboratories up to date?

It must be evident to our legislators that good business after the war will depend largely upon the new developments brought about by engineers. In the light of this dependence upon well trained engineers, perhaps some way can be found to apply the principle of lend-lease to equipment for engineering colleges to help the country's future.

That Ninety Million Offer for Puget Sound

CONSIDERABLE ATTENTION has been given in the press to the recent offer by Bonneville Administrator Raver of $90 million on behalf of a group of PUD's, Seattle and the federal government for the purchase of Puget Sound Power & Light electric properties. This isn't something new, it is but the latest of a number of offers going all the way back to 1933 when the late J. D. Ross offered $98 million for the whole thing. This is some $4 million more than the present offer when account is taken of the transportation, gas, telephone and steam heating properties not included in Raver's latest offer.

None of these offers has ever been backed up by legal authorization; the best that can be said of them is that they are feelers. The present one, however, is looked upon in the Northwest as the basis for propaganda which might be embarrassing to the company in view of the fact that a referendum is coming before the voters this fall to permit PUD's to band together for non-profit tax exempt utility operation.

Washington Comment

By R. N. LARKIN, Washington Correspondent

McKellar's Campaign Against TVA Autonomy

THE CURRENT CAMPAIGN against the autonomy of the Tennessee Valley Authority by Senator Kenneth McKellar, Tennessee Democrat, has widely been described either as an attempted patronage grab by McKellar or as a move by him to bring a callous bureaucracy to heel, or just a plain political feud.

The situation contains elements of each of these, but it is neither so simple nor so pat. Those who cry patronage point to McKellar's inability to dictate TVA personnel and charge that he included an amendment requiring Senate confirmation for all federal employees earning $4,500 yearly or more in a move to improve his position with regard to TVA patronage.

McKellar's is the loudest voice in support of the contention that this is an attempt to curb bureaucracy. The aging senator makes just a good enough case for this claim to merit attention.

If Congress Held Purse Strings

He argues that TVA could get along if it were to get all its funds from Congress in a direct appropriation and were to pay all its revenues into the Treasury. While this would cripple TVA's operational flexibility, it has not been demonstrated conclusively that TVA would perish under such law, as is claimed by McKellar's opponents. One senator cited a hurry call by a high-priority war producer for more power, to install which would cost TVA $40,000. If TVA were forced to withhold service pending an appropriation for this, the argument ran, war production would suffer. Actually, TVA has a $1,000,000 emergency fund, and none of McKellar's amendments would have touched it. Several $40,000 items could be covered by this fund pending an emergency appropriation.

During the war, any contingency affecting war production doubtless could be safely held an emergency item and so financed. After the war, TVA might reasonably be expected so to plan its yearly operations as to provide for most contingencies in its yearly request for funds, and the emergency pool would still be available.

On several minor points, also, McKellar makes sense enough to have an argument. When he cited payment by TVA for an audit of its books despite the law's provision only for an annual audit by the government accounting office, Lilienthal replied only that the law directed "business like" operation. Technically, McKellar was sound in criticizing such unauthorized expenditure. Lilienthal's fault lay not in having adopted a businesslike way of demonstrating his integrity over a $700 million business property but in having failed to demonstrate before Congress the necessity of such audit. His offense in proceeding without authorization, though trivial, is an example of administrative fiat to which Congress is becoming increasingly antagonistic. In view of McKellar's known animosity, Lilienthal should never have allowed this point and others like it to arise.

Distinction Without Difference

Despite the shortcomings on Lilienthal's part, McKellar's are less justifiable. The senator was downright insulting to Lilienthal as regards paying receipts into the Treasury. He described as "plain falsification" Lilienthal's contention that the TVA "returned $13,148,000 to the Treasury." This bitter charge McKellar based on testimony by Treasury officials that TVA had not turned such an amount into the Treasury's general fund. Actually, TVA deposited $13,148,000 in its own treasury account. That money was re-appropriated, saving a direct appropriation of $13,148,000. Nowhere did McKellar concede that $13,148,000 earned and plowed back is $13,148,000 saved the government.

Much more inexplainable was McKellar's amendment which reduced a $9,000,000 item for transmission lines to $600,000. Even though McKellar withdrew the amendment, the fact remains that he proposed, apparently in all seriousness, to halt transmission lines needed to get power into the TVA system from its new Fontana and Kentucky dams. These lines were approved by WPB's Office of War Utilities, which is responsible for electric power for war. The most cursory examination would have demonstrated the ridiculousness of building Fontana or Kentucky dams if no lines to move the power out were to be provided. Yet McKellar chose to second-guess OWU, in the same breath in which he castigated Lilienthal for second-guessing Congress on the location of TVA's headquarters, or for paying $30,000 for an audit of TVA's books.

Cooked Up Materials Shortage

Some of McKellar's statements are so uninformed as to be amusing. According to the senior senator from Tennessee, Lilienthal and OWU Director J. A. Krug, formerly TVA's manager of power, "cooked up" a specious shortage of materials for the purpose of thwarting Congress' desire that the South Holston and Wautauga dams be built. If the materials shortage which existed in this country in 1942 and 1943 was specious, then McKellar's political party should forever be banished from office for having inflicted a needless scarcity of arms on its fighting men, not to mention a needless scarcity of civilian goods on the public.

Materials were not so short, McKellar went on, that Fontana dam, "which was preferred by Lilienthal," could not be built. Admittedly the choice between Fontana or South Holston and Wautauga as to which will best serve the war program is one for power supply experts. But having sought to halt the transmission lines, McKellar does not qualify as such an expert.

These are not all the chinks in McKellar's armor, but they should be sufficient. It is regrettable that McKellar struck out so atrociously in this attempt to whip bureaucracy into line, for his performance will not improve the chances of future attempts at reform in cases where there is more justification.

NEWS OF THE WEEK

High Court Rebuffs OPA in Rate Case

Upholds Court of Appeals ruling sustaining PUC order granting Washington Gas Light increase — Doubts Stabilization Act confers "right" to intervene to economic stabilizer or agent

The Supreme Court ruled this week that the economic stabilizer may intervene in utility rate cases before constituted commissions only to the extent that regulatory commissions allow them to do so.

The decision was handed down by the high court in affirming a judgment of the U. S. Court of Appeals for the District of Columbia which had upheld an order by the D. C. Public Utilities Commission granting the Washington Gas Light Co. a rate increase of $201,000 annually. The PUC order had been vacated by the U. S. District Court, which in turn was overruled when the company appealed to the appeals court. The issue went to the Supreme Court on a writ of certiorari taken by Economic Stabilizer Fred M. Vinson and the Office of Price Administration, acting as his agent.

Majority Decision

Justices William O. Douglas, Hugo Black and Frank Murphy dissented. The majority opinion was read by Justice Owen Roberts.

The decision held that:

"The admission of the administrator (OPA) as intervenor was . . . not pursuant to statute but was governed by the commission's rules."

It added that "it is not clear" that the language of the Stabilization Act of 1942, which requires utilities to give the director of economic stabilization 30 days notice of any rate increase and to consent to intervention in any applicable litigation thereon, confers a "right" to intervention by the economic stabilizer. The court noted that in debate on the matter, the assertion was made that while the economic stabilizer could present his views on a rate increase to the commission in question, "he had nothing to say about its decision." This statement, the court added, was not contradicted.

"If the petitioners (OES and OPA) were admitted as intervenors . . .," the court held, "they might, of course, be admitted, . . . upon reasonable terms; one of the most usual procedural rules is that an intervenor is admitted to the proceeding as it stands and in respect to the pending issues, but is not permitted to enlarge those issues or compel an alteration of the nature of the proceeding."

The appeal had been taken on the basis that the PUC denied OPA "a full and fair hearing," and that under the law, OPA was "entitled to demand that the (D.C.) commission enlarge the scope of the hearing and convert the inquiry into one whether an increase of rates was necessary to prevent hardship." The PUC originally had scheduled the customary yearly investigation under the sliding-scale agreement which has governed gas rates in Washington since 1935. The high court pointed out that the commission had allowed OPA to intervene and that OPA had not introduced any evidence "relating to the inflationary effect, if any," of its order granting WGL a $201,000 rate boost, to which topic the PUC limited OPA as an intervenor.

The high court said it had "been asked to infer from a general expression of Congressional policy, the limitation of existing powers conferred by law on regulatory commissions . . . and the endowment of a different federal agency with new and superior rights and powers. This we are unable to do."

In his dissent, Justice Douglas argued that the Stabilization Act of 1942 confers the "right" of intervention on the economic stabilizer or his agent, and charged that:

Douglas Dissents

"The present decision goes far toward making that provision ineffective. It allows the commission so to shape the issues of the rate proceeding as to exclude the data most relevant to a determination of whether any rate increase should be allowed. The power of a commission to shape the issues as it desires and to restrict the director of economic stabilization to those issues is not a power which is apt to be neglected."

Douglas agreed "that Congress did not transfer ratemaking powers from the commissions to the director (of economic stabilization) . . . but I find not the slightest indication that the director was to be denied a full hearing."

Douglas added:

"I believe, moreover, that when Congress halted general rate increases and gave the director the right to intervene, it did not sanction rate increases regardless of need and regardless of inflationary effect. I think it meant to make utility commissions at least partial participants in the war against inflation and gave them a sector of the front to control. Though it did not remove the established standards for rate making, I do not think it intended utility commissions to proceed in dis-

regard of the requirements of emergency price control and unmindful of the dangers of general rate increases."

The decision came as a further defeat for OPA in its attempt to move in on utility rate making and provoked speculation as to whether OPA would attempt to have written into the Price Control Act, which expires June 30 and which is now before Congress for extension, authority for it to force utility commisisons to take and consider evidence it chooses to raise, regardless of the scope of any hearing called by a commisison into which OPA may have been permitted to intervene.

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Ickes Denied Control of Surplus Power

The House last week rejected an amendment to the $420,000,000 Omnibus Rivers and Harbors Bill which would have given Interior Secretary Harold L. Ickes the duty of selling surplus power generated at any dam authorized by the act.

It rejected also a provision of the bill which would have given the chief of engineers authority to construct power houses and install generating machinery in any dam heretofore or hereafter authorized by Congress on his own discretion.

Had the committee amendment giving Ickes control over surplus power provided under the act passed, Ickes' federal power empire would have crossed the Mississippi River toward the east for the first time, for three of the eight power dams in the bill lie east of the traditional boundary line of Interior Department power activities.

Rep. George A. Dondero, Michigan Republican, led the attack on the Ickes amendment, asserting that:

"This is not the first time that the secretary of the interior has sought to grab the political power that goes with the economic power of control of electric utilities owned by this nation." The amendment was written at the request of the President, Dondero said, asserting that the President doubtless did not have time to study the proposal but merely signed a letter handed him by Ickes.

After rejecting the Ickes amendment and striking the broad grant of authority to the chief of engineers, the House passed the omnibus bill, which authorized more than 200 stream and harbor improvements, including the Umatilla Dam on the Columbia River above Bonneville. No appropriation was made in the bill, which, if it passes the Senate, will provide a shelf full of postwar construction projects.

Charge Utility Opposition to Co-ops' Rural Program

Private power companies resist growth of rural electric co-operative movement, REA deputy administrator tells NRECA convention—WPB employees accused of partiality—State commissions also hit

The second annual meeting of the National Rural Electric Co-operative Association at Chicago, March 20 and 21, was marked by repeated sharp attacks on the private utility industry; by charges that WPB employees have shown partiality toward private utilities in approving rural line extensions and by the assertion that opposition to rural electric co-operatives is growing among state regulatory bodies.

Aside from a resolution extending NRECA support to the Senate argicultural committee investigation of REA and requesting speedy completion, relatively little reference was made to this investigation or to such figures as Ellis, Craig and Slattery.

Vincent D. Nicholson, deputy administrator and general counsel of REA, told NRECA delegates that opposition to the rural electrification program by private power interests is taking several forms: "spite lines" built to block co-ops from profitable territory; group opposition to the purchase by co-ops of utility properties and to the granting of "GT" (generation and transmission) loans that would permit co-operatives to become economically independent of private power sources.

Mr. Nicholson suggested that one effective strategy in combatting "spite lines" would be for co-ops to sign up new members in advance of construction and seek legal injunctions restraining competing interests from interference in established contracts. He charged that opposition to the growth of rural electric co-operatives is developing in state capitals under the influence of powerful lobbies. There is opposition to co-ops among state regulatory bodies, he indicated, pointing out that: "The utilities used to be regulated for the benefit of the public. Now the public is regulated for the benefit of the utilities."

"To Hell With the Law"

In his opening remarks Nicholson pointed out his enviable position as

NEW PRESIDENT TAKES OVER—Steve C. Tate, (left) former NRECA head, congratulates the association's new president, E. J. Stoneman (center), as Vice-president Charles S. Hooper looks on

deputy administrator and general counsel of REA. When something is proposed that as deputy administrator he does not want, he can as general counsel advise. "You can't do that. It's against the law." But when something is proposed that he wants he, speaking as deputy administrator, can tell the general counsel, "To hell with the law. Go ahead and do it."

Charges were presented on the floor of the meeting and before the resolutions committee of NRECA that WPB employees are placing obstacles in the way of approval of rural co-op line extensions while expediting approval of competing private power lines. These claims found recognition in a resolution, passed by a vote of 157 to 110 which claimed WPB bias and requested the agency to cause its employees to observe rules with impartiality as far as co-ops and private companies were concerned. Two co-ops were reported to have presented evidence to the resolutions committee in the form of letters and telegrams purporting to prove the claims of bias.

I. H. Hull, president of National Cooperatives Inc., urged rural electric co-ops to pay off their debts to the government and so help to reduce the national debt. Apparently referring to the investigation of REA, Hull said, "Even if you do have something in your set-up that isn't entirely right that is nothing to be scared about. Do a little housecleaning if necessary and then build a program to bring about economical freedom. Keep political complications in the background," he urged.

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N. Y. Legislature Passes St. Lawrence Resolution

The Graves St. Lawrence power development resolution was passed by both houses of the New York State Legislature. The resolution was introduced in the Senate by Mrs. Rhoda F. Graves, Republican.

A resolution previously introduced had coupled with the St. Lawrence development, further development of the Niagara River, but in its final form all mention of the latter was omitted.

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Completes 66-kv. Line

Construction of the second 66-kv. circuit from the Inglis steam plant of the Florida Power Corp. to the Dunnellon hydro plant has been completed and is now in operation. With two circuits now in operation between these plants, service to the central part of the system has been considerably strengthened.

ADDRESS ELECTRIC INSTITUTE—Eric Johnston (left) and Dr. William McClellan addressed the annual meeting of the Electric Institute of Washington held last week at the Hotel Statler. Mr. Johnston spoke on "American Business and the Peace" and Dr. McClellan on "The Electrical Industry"

Utility and Industrial Leaders Scan Post-War

Representatives of the electrical industry and other business executives attend annual meeting of Electric Institute of Washington — Eric Johnston principal speaker

As a curtain-raiser for the principal address of the evening by Eric Johnston, president of the Chamber of Commerce of the United States, at the tenth annual meeting of The Electric Institute of Washington last week. Dr. William McClellan, chairman of the board of the Union Electric Co. of Missouri, pointed out two things that give the utility industry a great deal of hope provided it will do its part.

The first is that whereas the community does for itself many things that private concerns could do, such as maintain the streets or provide water, it still permits the power company in most places to supply electric service. If the industry is to continue, it is obligated, he said "to provide a service for the community which would be better and cheaper than the community could provide for itself."

The second hope lay in erasing the complacency which may come with the operation of a monopoly, in encouraging enterprise in the individual employee and in building volume on small cost. This, he stated, will put people to work and in that connection the kilowatt-hour volume will have to be doubled.

After paying the utility industry a tribute for having "made a major contribution to this war and production," Mr. Johnston said: "There is probably no industry in America that has greater opportunities in the future."

Especial emphasis was laid by Mr. Johnston on the fact that America has not reached its last frontiers, that it has never produced enough for all its people and that there were never greater business opportunities than there will be after this war.

"We realize," Mr. Johnston said, "that when war ceases we will not have peace; we will have merely an armistice, that peace can come only when people have the mind and the will for peace; and that will take a change in our thinking, a change in our conception of the world of tomorrow. It may take decades to achieve that new conception. We must understand that one of the principles of that concept of the world of tomorrow is greater productivity, not only on the part of the American people but on the part of all peoples of the world. and that we in America must use our great position as the greatest creditor nation in the world, we must use our position of strength and leadership to assist in the industrialization and assist in the raising of the standards of living of other peoples of the world."

The thinking which caused the Potomac Electric Power Co. to withdraw from direct merchandising when the Institute was formed and the recog-

nition of industry inter-dependence was outlined by the company's president, A. G. Neal.

One of the Institute's post-war plans outlined by J. S. Bartlett, managing director, will be to supplement the efforts of manufacturers and wholesalers in the training of retail salesmen.

More than a thousand attended the meeting to which had been invited a large number of guests from government and war agencies, national industry associations, local business organizations and the press.

George F. Kindley, vice-president of Edgar Morris Sales Co., who served as president of the Electric Institute during 1942 and 1943, presided at the meeting. Officers of the Institute for 1944 were introduced. They include: President, L. S. McCarthy, Woodward & Lothrop; vice-president, N. H. Barnes, Potomac Electric Power Co.; secretary, K. D. Boucher, United Clay Products Co., and treasurer, N. E. Burdette, Refrigeration Supply Co., Inc.

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Swap Campaign Returns Reported by West Penn

As the Swap Campaign gathers momentum, reports from participating dealers prove that this activity has been more successful in unearthing idle electric appliances than was anticipated, West Penn Power Co. announced recently.

Early returns for February show a marked increase over those of January. Present indications are that appliances swapped for War Stamps in February will run about 20 percent higher than in the preceding month. Preliminary estimates for February swaps total approximately 2,100 units, it was stated.

Engineers Urged to Gauge Post-War "Work Pile"

Problems of operation under wartime conditions of insufficiencies in manpower and equipment, future problems when war is ended engage Atlanta meeting of Southeastern Electric Exchange

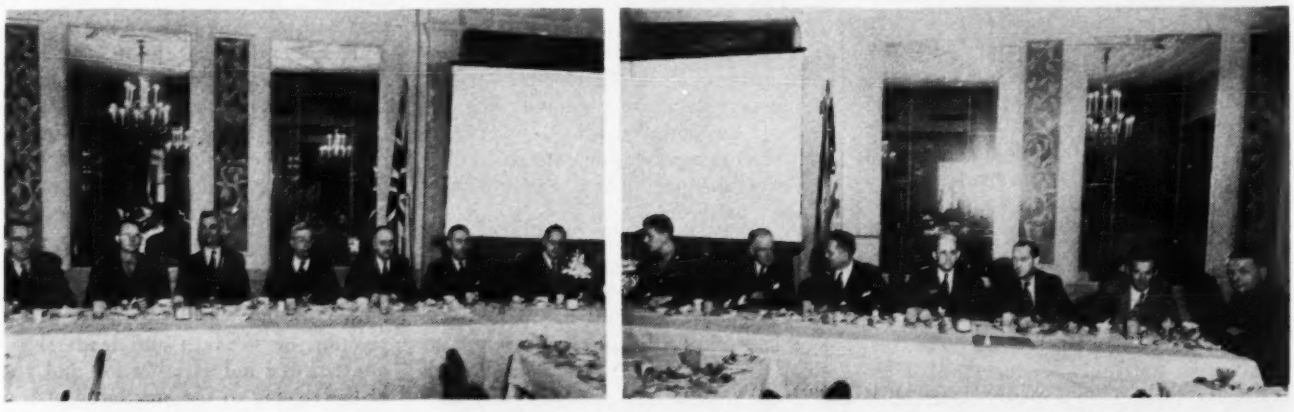
Urging that utility engineers figure out in manhours how much work will be piled up for doing when the war is over, R. B. Roberts, Florida Power & Light, opened the first session and set the tone for much of the discussion of the two-day meeting of the engineering and operation section of the Southeastern Electric Exchange in Atlanta last week. The "work pile" thus determined, said Mr. Roberts, should be publicized in striking fashion so that the people will know that the electric companies are ready and able to do their part in providing employment post-war.

That the engineers are having their present troubles as the post-war "work pile" accumulates was plain from the discussions led by E. L. Davis, Virginia Electric & Power, and by Harry G. Moore and M. L. Cathey, Georgia Power. Mr. Davis told of the tribulations of keeping an antiquated power plant in operation and evoked a flood of lugubrious testimony from others with the same kind of problems on their hands. Messrs. Moore and Cathey set out to define optimum make-ups of line crews for various kinds of work from which the meeting arrived at the consensus that until the war is over line crews should, and perforce will be, so constituted as to make best use of the manpower available and let the matter go at that.

Another contributor to the post-war "workpile" will be the easily foreseeable large amount of work to be done in relocating lines as a result of government plans for extensive highway construction. V. R. Parrack, Virginia Public Service presented the results of a survey of the plans for post-war road construction now being developed by the highway commissions of the southeastern states. Even though only one state, Virginia, has as yet gotten very far in fixing on a pattern of highway design, it is plain from the intentions expressed by the others that the utilities are going to be faced with a major problem of making their lines conform to highway projects.

More in the same direction was offered by P. G. Whitmore, Ebasco, in his paper on future rural electrification. He stated four things as necessary if the power companies are to compete effectively with REA for farm business. They are: lower costs for line extensions, lower operating costs, development of farm loads and specialized salesmanship to put into the hands of the farmer devices and equipments that will make a profit for him.

Integrated operation of power supply systems over large areas of the nation, from which such large advantages have been realized under wartime pressure, must continue and become even closer-knit when the war is over. That was the opinion generally expressed in discus-



DESCRIBES BOMBING—Southeastern engineers hear Air Corps sergeant tell of bombing Germany. From the left: R. B. Roberts, Florida Power & Light; Major R. M. Bush, G. I. Branch, Ebasco; C. W. Mayott, Office of War Utilities; C. H. Reker, Ebasco; O. O. Rae, Westinghouse; P. J. Carlin, Chairman; Sergeant H. B. Flaugh; E. H. Ginn, General Electric; Frank R. Innes, *Electrical World*; Edward Allen, *Electric Light and Power*; Henry Sargent, Mississippi Power & Light; D. S. Kerr, Allis-Chalmers; R. I. Butterworth, East Tennessee Light & Power

sion of the paper on telemetering and tie-line load control equipment by T. H. Mawson, Commonwealth & Southern. There could be no question of that opinion after hearing the report made to the meeting by C. W. Mayott, Office of War Utilities, on how integration of southeastern systems is working out. Co-ordination of operations among systems is remarkably smooth, said Mr. Mayott, and the results therefrom will not be given up when the war is ended.

An ingenious method for simplifying problems of relay and fuse co-ordination was presented by C. H. Summers, Florida Power & Light. Apparently there are no insurmountable difficulties in the way of using voltages higher than 5,000 on lines or poles that also carry telephone conductors, according to a discussion led by George M. Nelson, Eastern Shore Public Service. The meeting regarded favorably, by a show of hands, a suggestion presented by D. V. Hyer, on behalf of C. B. McCartney, Florida Power Corp., for work towards standardization of distribution construction practices in the Southeast.

A new thing in plastic type of insulation, Fosterite, which effectively seals against entrance of moisture, was described by J. K. Hodnette, Westinghouse, and the virtues and advantages of frequency modulation for two-way communication with line crews were set forth in convincing details by D. L. Chestnut, General Electric. What has been accomplished in the Southeast by the Utilities Wartime Aid Program was recounted by W. R. Doar, Carolina Power & Light. F. A. Lane, Appalachian Electric Power, described a pair of replacement transformers mounted on railroad cars which can take over load in emergency at 161 different places on the system.

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Los Angeles Employees Get Another Pay Raise

Another $5 raise recently was granted by the board of water and power commissioners to 3,400 employees of municipally-owned Los Angeles Department of Water and Power, whose 10-day wage strike crippled the southern California city in February.

The monthly wage increase affects all workers earning $350 a month or less, and, coupled with a $5 raise in February, brings employees to within $5 of the $15 increase demanded by them following their walkout.

The pay increase was awarded as a temporary measure pending a final report to be submitted to the board by a three-man wage survey committee and was recommended on the basis of increased living costs.

REA to Get $20,000,000 Fund Under House Bill

Measure before Senate—Amendment prohibiting purchase of existing systems defeated in House—REA total power bill $13,890,000 in 1943—Consumption increased heavily during war

The Agriculture Appropriation bill, containing $20,000,000 in new loan funds for REA plus unexpended balances as of next June 30, expected to total between $1,000,000 and $3,000,000, and $2,550,000 for administrative expenses, was before the Senate this week after having been passed by the House.

An amendment by Rep. Lyle Boren, Oklahoma Democrat, seeking to prohibit the use of REA funds for the purchase of existing electrical systems or for erection of systems in municipalities of more than 1,500 population was defeated by a voice vote. Boren told ELECTRICAL WORLD that he doubted the amendment would be revived in the Senate.

Even Rept. Everett M. Dirksen, Illinois Republican and a long-time critic of REA's acquisition program, urged defeat of the amendment, arguing that in some instances, REA's only opportunity of developing unserved rural areas lies in its right to purchase an existing systems and expand therefrom into the unserved area.

Hearings before the House Appropriations sub-committee revealed that REA allotted $17,418,928 between last July 1 and Febt. 15, of which $11,235,480 was actually advanced. From July 1, 1943, to last Feb. 1, 136 applications to serve military or industrial loads were received by REA.

Deputy Administrator William J. Neal told the committee that REA expects "the acquisition program . . . (to) continue very active during the remainder of the fiscal year of 1944 (ending June 30) and through the fiscal year of 1945." Acquisition allotments from last June 30 through Feb. 15 totaled $5,530,971, more than in the entire fiscal year of 1943, he went on with more than half of this sum to be spent on additions to the purchased systems.

Neal told the committee that $48,157,727 has been allotted by REA for

FARM EQUIPMENT DISPLAY—On the showroom floor of Wisconsin Public Service Corp., Green Bay, this full-color display is currently pointing up interest in home made chick and pig brooders which the utility has been recommending to farmers. A small feed grinder and farm water system are also part of the colorful exhibit which is the work of display manager Karl Rockstroh, at right above

system acquisitions since the acquisition program began, although not all of it has yet been spent. Loans involving acquisitions total 320, he added, but of the $48,000,000 involved in these loans, only $18,620,358 has been allotted for the actual purchase of existing systems. The remainder has been allotted for system rehabilitation and the construction of new lines into territory as yet unserved at the time of purchase, he said.

Neal testified that 66 acquisitions were closed during the fiscal year of 1943 and that 19 has been closed between June 30, 1943, and Feb. 25, 1944. During fiscal 1943, 25 acquisition allotments were made, and during fiscal 1944, up to last Feb. 25, 19 acquisition allotments has been made. Deals involving 24 other acquisitions were expected to be closed by next July 1, and 11 other possible acquisitions were "under consideration."

Total power bill of all REA co-operatives during fiscal 1943 was $13,890,000, Deputy Administrator V. D. Nicholson told the committee, of which $7,000,000 went to privately owned electric companies, the remainder to "public agencies of one kind or another." In fiscal 1943, 94 applications for service to military loads were received by REA borrowers, of which 26 connections failed to bring about any new service to farmers.

Consumption by rural users connected to REA lines has increased heavily during the war, Neal testified. He told the committee that kilowatt-hours billed by all REA borrowers during the fiscal year of 1942 totaled 893,000,000, rising in fiscal 1943 to 1,460,000,000 and in fiscal 1944 to the rate of 1,700,000,000 kw.-hr. annually.

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Insists Congress Allot TVA Funds

The independent Offices Appropriation Bill, minus 16 amendments curtailing the freedom of the Tennessee Valley Authority but providing that TVA shall operate solely on funds appropriated directly by the Congress, was back in the House this week with the Senate insusting on concurrence in its amendments.

Appropriations for the Federal Power Commission and the Securities and Exchange Commission were not affected by Senate action on the bill.

Sen. Kenneth McKellar, Tennessee Democrat, conceded defeat on his minor amendments (ELECTRICAL WORLD, March 18, p. 97) but fought through his amendment requiring that TVA turn its revenues into the Treasury's general fund and operate solely on direct Congressional appropriations. He increased to $79,134,882 the direct appropriation for TVA, a boost of about $3,000,000 and agreed to remove his ban on completion of units at the Watts Bar steam plant and Kentucky Dam as well as on several transmission lines.

Some House members predicted that the amendment requiring TVA to operate solely on direct appropriations, turning its revenues into the Treasury's general fund, would pass the House. Its chances there were tied up to two other controversial amendments to the Independent Offices Bill, one by McKellar requiring Senate confirmation of all federal employees earning more than $4,500 yearly, and another by Sen. Richard V. Russell, Georgia Democrat, junking federal agencies which have been in existence for a year or more without direct Congressional approval. The former was passed last year by the Senate but discarded by the House, which had no hand in the patronage which would have resulted. The Russell amendment would hit nearly a score of agencies established by executive order and never specifically approved by Congress. Outstanding among these is the Fair Employment Practice Committee, against which Southern Congressmen have been fighting for some time, particularly since FEPC's order of several months ago directing southern railroads not to discriminate against Negroes.

MEETINGS

Pennsylvania Electric Association — Electrical equipment committee, Lancaster, Pa., May 10-11. A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

Edison Electric Institute—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 6-7. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Public Utilities Advertising Association—Annual meeting, Palmer House, Chicago, Ill., June 6-8. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

National District Heating Association—Annual meeting, William Penn Hotel, Pittsburgh, Pa., June 14-15. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

Iowa Utilities Association — Post-war planning conference, Des Moines, Iowa, June 19-20. Wm. R. Blake, secretary-manager, 606 Fleming Bldg., Des Moines, Iowa.

American Society of Mechanical Engineers — Semi-annual meeting, William Penn Hotel, Pittsburgh, Pa., June 19-22. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Canandian Electrical Association—Annual meeting, Murray Bay, Que., Canada, June 22-23. B. C. Fairchild, managing director, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education—Annual meeting, University of Cincinnati, Cincinnati, Ohio, June 25-28. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

Previously Listed

American Society of Mechanical Engineers—Spring meeting, Hotel Tutwiler, Birmingham, Ala., April 3-5. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York 18, N. Y.

Edison Electric Institute—Annual commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 3-5; technical committee meetings, Edgewater Beach Hotel, Chicago, Ill., May 1-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Missouri Valley Electric Association—Engineering conference, Continental Hotel, Kansas City, Mo., April 6-7. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

National Association of Corrosion Engineers—Annual conference, Rice Hotel, Houston, Texas, April 10-12. O. C. Mudd, acting secretary-treasurer, c/o Shell Pipe Line Corp., Box 2648, Houston 1, Texas.

Electrochemical Society—Spring meeting, Hotel Pfister, Milwaukee, Wisc., April 12-15. Colin G. Fink, secretary, Columbia University, 302 Broadway, New York 27, N. Y.

Midwest Power Conference—Palmer House, Chicago, Ill., April 13-14. Stanton E. Winston, director, Illinois Institute of Technology, Chicago, Ill.

American Institute of Electrical Engineers—Northeastern district, Hotel Statler, Boston, Mass., April 19-20; national technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

Missouri Association of Public Utilities—Annual meeting, Jefferson Hotel, St. Louis, Mo., April 19-20. Jesse Blythe, assistant secretary, 10 West High St., Jefferson City, Mo.

National Electrical Wholesalers Association—Second war conference, Stevens Hotel, Chicago, Ill., April 19-22. C. G. Pyle, managing director, 500 Fifth Ave., New York 18, N. Y.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., April 24-27. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

Illuminating Engineering Society—Southwestern regional meeting, Hotel Baker, Dallas, Texas, April 25; V. J. Graham, regional vice-president, General Electric Co., 1801 N. Lamar St., Dallas 2, Texas. Great Lakes regional meeting, Cincinnati, Ohio, May 20; G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland 12, Ohio.

National Fire Protection Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 8-11. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston 10, Mass.

Pacific Coast Electrical Association—Annual meeting, Northern section, Fairmont Hotel, San Francisco, Calif., May 10; southern section, Ambassador Hotel, Los Angeles, Calif., May 1. Victor W. Hartley, managing director, 601 W. Fifth St., Los Angeles, Calif.

Southeastern Electric Exchange—Annual conference, Atlanta Biltmore Hotel, Atlanta, Ga., May 10-11. John W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

Pennsylvania Electric Association—Systems operation committee, Benjamin Franklin Hotel, Philadelphia, Pa., May 11-12. E. W. Middleton, chairman, Pennsylvania Power & Light Co., Hazleton, Pa.

Arkansas Utilities Association—Annual convention, Marion Hotel, Little Rock, Ark., May 15. R. E. Ritchie, secretary, P.O. Box 551, Little Rock, Ark.

Output Curve Turns Upward

The output curve turned slightly upward for the week ended March 25, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,409,159,000 kw.-hr., as compared to the figures of 4,400,246,000 kw.-hr. for the week previous, which ended on March 18, 1944. Figures for the week represented an increase of 12.2 percent over the 3,928,170,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, the total being 3,345,502,000 kw.-hr.

All of the seven major geographic regions of the country reported increases for the week, the Pacific Coast region continuing to lead the field with an individual gain of 28.0 percent. The Mid-Atlantic group continued to hold second place with an increase of 11.4 percent and the Southern States region ran a close third with an increase of 11.1 percent. The gain reported by the New England section was only 4.7 percent, compared with an increase of 5.2 percent last week. The Central Industrial reported an increase of 9.5 percent; West Central, 6.6 percent and Rocky Mountain, 6.5 percent.

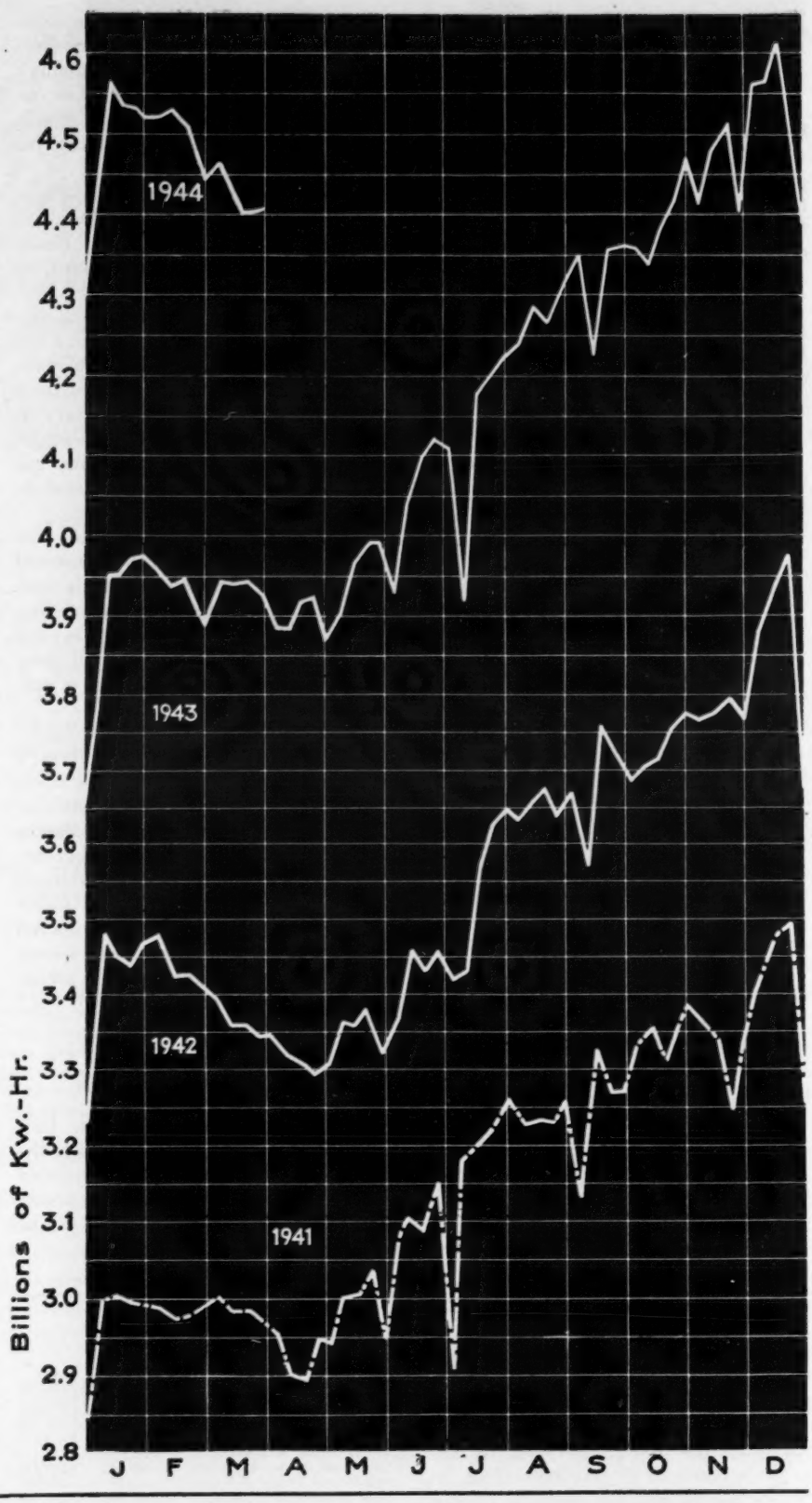
Weekly Output, Millions Kw.-Hr.

1944		1943		1942	
Mar. 25	4,409	Mar. 27	3,928	Mar. 28	3,346
Mar. 18	4,400	Mar. 20	3,947	Mar. 21	3,357
Mar. 11	4,426	Mar. 13	3,945	Mar. 14	3,357
Mar. 4	4,465	Mar. 6	3,947	Mar. 7	3,392
Feb. 26	4,444	Feb. 27	3,892	Feb. 28	3,409
Feb. 19	4,511	Feb. 20	3,948	Feb. 21	3,423
Feb. 12	4,532	Feb. 13	3,939	Feb. 14	3,421
Feb. 5	4,523	Feb. 6	3,960	Feb. 7	3,475
Jan. 29	4,523	Jan. 30	3,976	Jan. 31	3,468
Jan. 22	4,531	Jan. 23	3,974	Jan. 24	3,440
Jan. 15	4,539	Jan. 16	3,952	Jan. 17	3,450
Jan. 8	4,567	Jan. 9	3,952	Jan. 10	3,473

Percent Change from Previous Week

	Week Ending		
	Mar. 25	Mar. 18	Mar. 11
New England	+ 4.7	+ 5.2	+ 7.0
Mid-Atlantic	+11.4	+10.7	+12.6
Central Industrial	+ 9.5	+ 8.8	+ 8.9
West Central	+ 6.6	+ 6.1	+ 5.7
Southern States	+11.1	+ 9.5	+11.2
Rocky Mountain	+ 6.5	+ 5.2	+ 5.6
Pacific Coast	+28.0	+28.3	+27.2
Total United States*	+12.2	+11.5	+12.2

*Subject to revision.



Predicts 50% Increase in Home Consumption

Home use of electricity can be expected to increase 50 percent in the first five years following the war, D. B. Leonard, commercial manager of Pacific Power & Light Co., told members of the Electric Club of Portland, Ore.

Average cost of electricity can be expected to keep on going down, Mr. Leonard declared.

"As long as both public and private electric systems are represented in the Pacific Northwest power picture, the consumer is going to get the benefit of a keenly competitive psychological situation," he commented.

New Commission Head

Arkansas Utilities Commission has elected Marvin Hathcoat of Harrison as its chairman, succeeding A. B. Hill. The commission established the practice of naming a new chairman annually in 1943. Mr. Hill will remain as a member of the commission.

Name Prentiss Brown to Head Utility

Alfred C. Marshall, president of the Detroit Edison Co., announced last week that directors of the company planned to elect Prentiss M. Brown, former Congressman, U. S. Senator from Michigan and one-time director of OPA, as chairman of the board at a meeting to be held a month hence. Mr. Marshall stated that he will retire as president to be succeeded by James W. Parker, now vice-president and general manager. Mr. Marshall will continue as a director of the company and as a consultant.

"It is the intention of the board of directors then," Mr. Marshall said, "to amend the by-laws to create the executive office of chairman of the board, to elect Mr. Prentiss M. Brown to that office and to elect Mr. James W. Parker, now vice-president and general manager of the company, as president. The directors propose to take this action pursuant to my request to be relieved of my executive responsibility at the earliest convenient date. . . .

"When in the near future I retire as president of the Detroit Edison Co. it will afford me much personal pleasure and satisfaction to be able to place into the competent hands of Messrs. Brown and Parker the executive direction of the company with which I have had the privilege of serving so long. At the request of the board I shall continue as a director of the company and as a consultant."

Mr. Marshall, who succeeded Alex Dow as president of the Detroit utility in 1940, has been connected with the organization since 1893.

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Offer $90,000,000 for Puget Sound

Dr. Paul J. Raver, Bonneville power administrator, acting as agent for 16 public utility districts in Washington, the city of Seattle and the federal government in the matter of the proposed purchase by these interests of the properties of the Puget Sound Power & Light Co., made his "offer" last week. It was to the amount of $90,000,000. This includes the $33,000,000 recently offered by the PUDs and a recommended $30,000,000 to be borne by the federal government. That leaves $27,000,000 as the amount Seattle would need to raise.

In the event that the company accepts the offer, the matter would then have to be submitted to three governmental agencies—the U. S. Congress, the city of Seattle, and the PUDs.

It is also contemplated in the joint acquisition program that the U. S. Government will purchase the company's Rock Island dam and power plant on the Columbia river to permit co-ordinated operation of all Columbia river hydroelectric developments.

Puget Sound Power & Light Co. President Frank McLaughlin indicated in New York that the offer of Dr. Raver cannot, under present circumstances, be regarded as a qualified bid.

"I cannot see," said Mr. McLaughlin, "that the Bonneville Administrator's letter constitutes a firm bid with cash available for the acquisition of the company's electric properties. On the contrary, it appears to be a mere exploration of the receptivity of the company to a firm bid when and if one can be produced at some indifinite time in the future.

"The letter indicates that all the Bonneville Administrator is empowered to do is to talk, and even if a satisfactory price were agreed upon, he cannot commit the PUDs, the city of Seattle, and Congress. But the approval of all these bodies must be obtained before a sale can be effected. . ."

Paul B. McKee, president of Pacific Power & Light Co., termed Dr. Raver's "offer" just another propaganda effort on the part of the power socialists who want all electric service in the Pacific northwest to be controlled by a bureaucratic monopoly." "These ambitious bureaucrats," said Mr. McKee, "figure that if they make enough conversation about buying this or that power system they may eventually get people to accept the idea as an accomplished fact. . . ."

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Makes Television Plans

Westinghouse Radio Stations, Inc., has announced that it has applied to the Federal Communications Commission for licenses for three television broadcasting stations to be built at Philadelphia, Boston and Pittsburgh.

Utility Reports

	1944	1943
*Arkansas Power & Light...	$1,087,100	$1,177,249
*Birmingham Electric	1,297,986	1,274,898
*Carolina Power & Light...	2,485,248	2,332,288
*Connecticut Light & Power	3,713,009	3,618,313
*Dallas Power & Light.....	1,542,254	1,488,610
*Louisiana Power & Light..	886,384	1,237,293
*Mississippi Power & Light.	624,991	688,965
*New Orleans Pub. Serv....	1,799,795	2,239,085
*Pensylvania Power & Light.	5,789,730	5,522,567
*Texas Power & Light.....	2,740,324	1,937,355
	1943	1942
†Appalachian Elec. Power..	4,476,263	4,925,603
†Consumers Power	12,985,368	12,088,394
†Duquesne Light	10,548,453	11,070,048
†Kansas City Power & Light	2,992,967	2,868,554
†Oklahoma Gas & Electric..	2,562,425	2,365,244
†So. Colorado Power.....	298,763	314,341
†Union Electric Missouri...	8,355,494	7,763,876

*Twelve months ended January 31.
†Twelve months ended December 31.

OPA Weighs Control of Electric Rates

The Office of Price Administration will decide within the next 60 days whether to establish area maximum prices for electric service in seven states where electric rates are not regulated.

Acting under a Supreme Court decision (ELECTRICAL WORLD, Feb. 12, 1944, p. 5), OPA amended its regulations to require electric utilities whose rates are not regulated (Delaware, Florida, Iowa, Minnesota, Mississippi, Nebraska and South Dakota) to file notice of any proposed rate increase under its procedural regulation 11. This requirement will be in effect for 60 days, during which time OPA will determine whether to: (1) Continue the notice requirement; (2) establish area maximum rates for those unregulated industries in which the increases reported appear contrary to the stabilization program; (3) extent the scope of complete exemption.

This move will have no effect on electric companies in states where rates are regulated. They will continue to report proposed rate increases 30 days or more before the effective date.

Telephone and telegraph companies and common carriers whose rates are not regulated were exempted from compliance with regulation 11 since they are selling services over which OPA has no jurisdiction. Electric water and gas companies whose rates are not regulated were ordered to report proposed increases during the next 60-day period pending determination by OPA of what it will do relative to stabilizing unregulated rates. Electric, water and gas companies were required to file since they sell commodities, over which OPA has jurisdiction.

The matter arose when the Supreme Court upheld the Davies Warehouse Company, of Los Angeles, which had been prohibited by OPA from instituting a rate increase approved by the California Commission. The high court ruled that companies whose rates are regulated are public utilities and thus exempt from OPA price control.

OPA thereupon examined the position of companies normally considered public utilities but whose rates are not regulated.

It was apparent that if OPA decides to establish area maximum prices for electric service in unregulated areas, existing rates may be lowered. It has been a keystone of OPA philosophy to cut the price of a commodity whose profit margin can stand a squeeze to make up for OPA's inability to hold prices steady on other components of the cost of living.

3 GOOD REASONS

WHY YOU SHOULD USE

Novalux

SERIES SOCKETS

1. RADIO INTERFERENCE and ARCING PREVENTED

by sturdy one-piece construction of current-carrying parts.

2. GOOD FIT IN ALL LUMINAIRES

obtained by carefully designed prong shape.

3. LOW-COST REPLACEABLE SHELL

either porcelain or Textolite, saves money and metal.

These sturdy, high-quality series sockets will save time and money on maintenance—and, equally important, they will prevent many service outages. They easily withstand the temperature changes, vibration, and atmospheric corrosion that have often caused street-lighting sockets to fail. Of course, they are standard equipment for G-E Novalux luminaires—but regardless of what make of luminaire you are using, you can use Novalux sockets as replacements.

For further information, address the nearest G-E office or agent. *General Electric Company, Schenectady 5, N. Y.*

Novalux Renewal Parts catalog, complete, well-illustrated, facilitates checking stock and ordering parts. Write for a copy of GEA-4084.

High-quality, Low-cost Cutouts

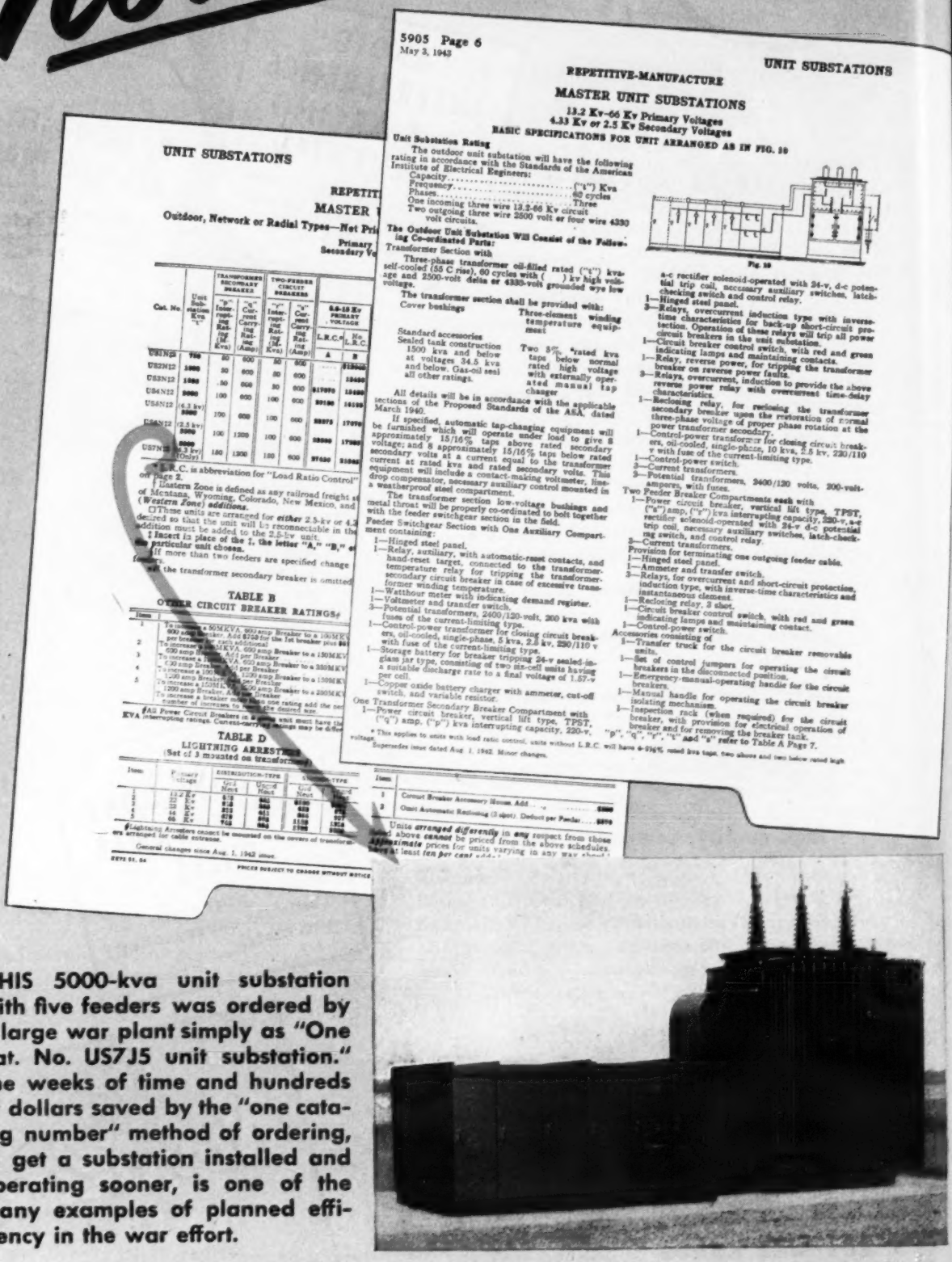
Good series sockets deserve good cutouts. G-E Novalux copper-oxide film cutouts are good because (1) their carefully controlled dielectric value is not affected by heat or pressure, and (2) a moistureproof, metal-and-fiber casing prevents damage to the dielectric film.

BUY WAR BONDS

GENERAL ELECTRIC

Novalux RENEWAL PARTS for Luminaires

Now YOU CAN ORDER



5905 Page 6
May 3, 1943

UNIT SUBSTATIONS

REPETITIVE-MANUFACTURE

MASTER UNIT SUBSTATIONS

13.2 Kv–66 Kv Primary Voltages
4.33 Kv or 2.5 Kv Secondary Voltages

BASIC SPECIFICATIONS FOR UNIT ARRANGED AS IN FIG. 10

Unit Substation Rating

The outdoor unit substation will have the following rating in accordance with the Standards of the American Institute of Electrical Engineers:

Capacity.....("s") Kva
Frequency.....60 cycles
Phases.....Three
One incoming three wire 13.2-66 Kv circuit
Two outgoing three wire 2500 volt or four wire 4330 volt circuits.

The Outdoor Unit Substation Will Consist of the Following Co-ordinated Parts:

Transformer Section with

Three-phase transformer oil-filled rated ("s") kva self-cooled (55 C rise), 60 cycles with ( ) kv high voltage and 2500-volt delta or 4330-volt grounded wye low voltage.

The transformer section shall be provided with:

Cover bushings
Three-element winding temperature equipment

Standard accessories
Sealed tank construction 1500 kva and below at voltages 34.5 kva and below. Gas-oil seal all other ratings.

Two 5% *rated kva taps below normal rated high voltage with externally operated manual tap changer

All details will be in accordance with the applicable sections of the Proposed Standards of the ASA, dated March 1940.

If specified, automatic tap-changing equipment will be furnished which will operate under load to give 8 approximately 15/16% taps above rated secondary voltage; and 8 approximately 15/16% taps below rated secondary volts at a current equal to the transformer current at rated kva and rated secondary volts. This equipment will include a contact-making voltmeter, line-drop compensator, necessary auxiliary control mounted in a weatherproof steel compartment.

The transformer section low-voltage bushings and metal throat will be properly co-ordinated to bolt together with the feeder switchgear section in the field.

Feeder Switchgear Section with One Auxiliary Compartment containing:

1—Hinged steel panel.
1—Relay, auxiliary, with automatic-reset contacts, and hand-reset target, connected to the transformer-temperature relay for tripping the transformer-secondary circuit breaker in case of excessive transformer winding temperature.
1—Watthour meter with indicating demand register.
1—Voltmeter and transfer switch.
3—Potential transformers, 2400/120-volt, 200 kva with fuses of the current-limiting type.
1—Control-power transformer for closing circuit breakers, oil-cooled, single-phase, 5 kva, 2.5 kv, 230/110 v
1—Storage battery for breaker tripping 24-v sealed-in-glass jar type, consisting of two six-cell units having a suitable discharge rate to a final voltage of 1.87-v per cell.
1—Copper oxide battery charger with ammeter, cut-off switch, and variable resistor.

One Transformer Secondary Breaker Compartment with

1—Power circuit breaker, vertical lift type, TPST, ("q") amp. ("p") kva interrupting capacity, 220-v.

Fig. 10

4-c rectifier solenoid-operated with 24-v, d-c potential trip coil, necessary auxiliary switches, latch-checking switch and control relay.
1—Hinged steel panel.
3—Relays, overcurrent induction type with inverse-time characteristics for back-up short-circuit protection. Operation of these relays will trip all power circuit breakers in the unit substation.
1—Circuit breaker control switch, with red and green indicating lamps and maintaining contacts.
1—Relay, reverse power, for tripping the transformer breaker on reverse power faults.
3—Relays, overcurrent, induction to provide the above reverse power relay with overcurrent time-delay characteristics.
1—Reclosing relay, for reclosing the transformer secondary breaker upon the restoration of normal three-phase voltage of proper phase rotation at the power transformer secondary.
1—Control-power transformer for closing circuit breakers, oil-cooled, single-phase, 10 kva, 2.5 kv, 220/110 v with fuse of the current-limiting type.
1—Control-power switch.
3—Current transformers.
3—Potential transformers, 2400/120 volts, 200-volt-amperes, with fuses.

Two Feeder Breaker Compartments each with

1—Power circuit breaker, vertical lift type, TPST, ("s") amp, ("r") kva interrupting capacity, 220-v, a-c rectifier solenoid-operated with 24-v d-c potential trip coil, necessary auxiliary switches, latch-checking switch, and control relay.
3—Current transformers.

Provision for terminating one outgoing feeder cable.

1—Hinged steel panel.
1—Ammeter and transfer switch.
3—Relays, for overcurrent and short-circuit protection, induction type, with inverse-time characteristics and instantaneous element.
1—Reclosing relay, 3 shot.
1—Circuit breaker control switch, with red and green indicating lamps and maintaining contact.
1—Control-power switch.

Accessories consisting of

1—Transfer truck for the circuit breaker removable units.
1—Set of control jumpers for operating the circuit breakers in the disconnected position.
1—Emergency-manual-operating handle for the circuit breakers.
1—Manual handle for operating the circuit breaker isolating mechanism.
1—Inspection rack (when required) for the circuit breaker, with provision for electrical operation of breaker and for removing the breaker tank.

"p", "q", "r", "s" and "t" refer to Table A Page 7.

* This applies to units with load ratio control; units without L.R.C. will have 6-5/8% rated kva taps, two above and two below rated high voltage.

Supersedes issue dated Aug. 1, 1942. Minor changes.

UNIT SUBSTATIONS

REPETIT
MASTER
Outdoor, Network or Radial Types—Not Pri
Primary
Secondary Vo

Cat. No.	Unit Substation Kva "s"	TRANSFORMER SECONDARY BREAKER "p" Interrupting Rating (M.V.A. Kva)	TRANSFORMER SECONDARY BREAKER "q" Current Carrying Rating (Amp)	TWO-FEEDER CIRCUIT BREAKERS "r" Interrupting Rating (M.V.A. Kva)	TWO-FEEDER CIRCUIT BREAKERS "s" Current Carrying Rating (Amp)	6.6-15 Kv PRIMARY VOLTAGE L.R.C.*	6.6-15 Kv PRIMARY VOLTAGE No L.R.C.
US1N12	750	50	600	50	600	.....	$13,500
US2N12	1000	50	600	50	600	.....	13,650
US3N12	1500	50	600	50	600	$17,970	13,650
US4N12	2000	100	600	100	600	$20,190	16,150
US5N12	(4.3 kv) 2000 (2.5 kv)	100	600	100	600	$20,970	17,970
US6N12	3000	100	1200	100	600	$20,990	17,990
US7N12	5000 (4.3 kv) (Only)	100	1200	100	600	$17,650	$19,990

* L.R.C. in abbreviation for "Load Ratio Control"

on Page 2.

† Eastern Zone is defined as any railroad freight s
of Montana, Wyoming, Colorado, New Mexico, and
(Western Zone) additions.

‡These units are arranged for either 2.5-kv or 4.3
designed so that the unit will be reconnectable in th
addition must be added to the 2.5-kv unit.
Insert in place of the 7, the letter "A," "B," o
particular unit chosen.
If more than two feeders are specified change
f
nit the transformer secondary breaker is omitted

TABLE B
OTHER CIRCUIT BREAKER RATINGS‡

Item	
1	To increase a 50 MVA, 900 amp Breaker to a 150 MV 600 amp Breaker. Add $750 for the 1st breaker plus $4 per breaker (add'l) additional
2	To increase a 150 MVA, 600 amp Breaker to a 150 MV 1200 amp Breaker. Add per Breaker
3	To increase a 150 MVA, 600 amp Breaker to a 350 MV per Breaker
4	To increase a 150 MVA, 1200 amp Breaker to a 350 MV per Breaker
5	To increase a 150 MVA, 1200 amp Breaker to a 250 MV per Breaker

All Power Circuit Breakers in a given unit must have the KVA interrupting ratings. Current-carrying ratings may be di

TABLE D
LIGHTNING ARRESTERS
(Set of 3 mounted on transformer)

Item	Primary Voltage	DISTRIBUTION-TYPE Unit Heavy	DISTRIBUTION-TYPE Unit Medium	STATION-TYPE Unit Heavy	STATION-TYPE Unit Medium
1	13.2 Kv	$ 73	$ 66	$1,020	$ 765
2	22 Kv	81	66	1,020	765
3	33 Kv	87	66	1,020	765
4	44 Kv	87	66	1,020	765
5	66 Kv	87	66	1,020	765

Lightning Arresters cannot be mounted on the covers of transfor
are arranged for cable entrance.

General changes since Aug. 1, 1942 issue.

KEYS 51, 54

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Item	
1	Circuit Breaker Accessory House, Add $300
2	Omit Automatic Reclosing (3 shot). Deduct per Feeder $870

Units *arranged differently* in *any* respect from those above *cannot* be priced from the above schedules. *Approximate* prices for units varying in any way should at least *ten per cent* add

THIS 5000-kva unit substation with five feeders was ordered by a large war plant simply as "One Cat. No. US7J5 unit substation." The weeks of time and hundreds of dollars saved by the "one catalog number" method of ordering, to get a substation installed and operating sooner, is one of the many examples of planned efficiency in the war effort.

A COMPLETE SUBSTATION BY ONE CATALOG NUMBER

—a result of standardization and repetitive manufacture*

What G-E *unit substations* offer you:

LOWER CAPITAL INVESTMENT. Unit substations have opened a profitable new field for electric-service company distribution engineers who right now are studying their systems with a view to avoiding unnecessarily large capital expenditures. The valuable time normally spent in worrying about substation-design details can now be much more profitably devoted to *system* engineering and planning.

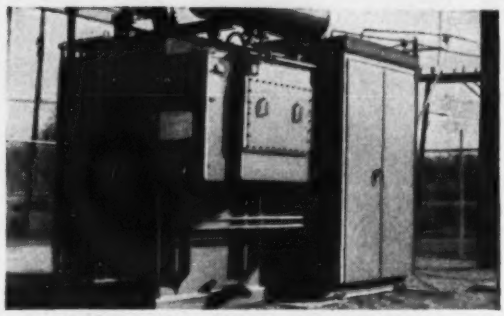
BETTER SYSTEM OPERATION. A well-planned system, one which has completely automatic, standard *unit substations,* means fewer customer outages, better voltage conditions, and a lower equipment-failure rate. The dispersal provided by a number of smaller units, compared with one large, central substation, localizes troubles and prevents huge equipment losses as well as large-area outages resulting from fires, explosions, or other misfortune.

GREATER FLEXIBILITY. *Shifting* loads are easy to follow because these standardized units are relatively easy to move. *Increasing* loads are easy to handle by purchasing additional units as they are needed. This precludes the possibility of installing a large substation and waiting for a load which may never develop.

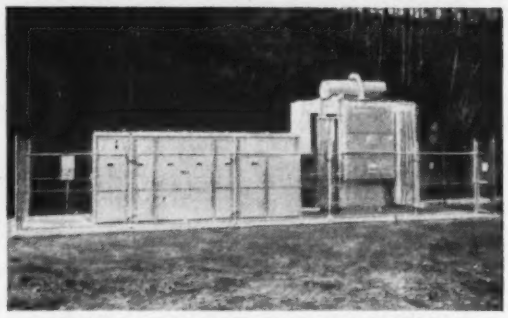
LOWER OVERHEAD. G-E *unit substations* are shipped directly to the installation site in completely assembled sections. You save the time and expense of passing hundreds of parts through stockroom or warehouse. You avoid the confusion of lost, delayed, or forgotten parts and duplicate pieces, rush orders, and consequent rehandling. Installation is always much easier and faster than it is with a piecemeal substation, and there can be a more efficient use of man power. Crews quickly become familiar with them because there are only two or three pieces to handle.

CENTRALIZED RESPONSIBILITY. The combined and co-ordinated efforts of General Electric's substation, transformer, switchgear, relay, meter, and application engineers assure the fulfillment of your specifications. The constant efforts of this highly trained group mean continued improvements in available standard unit substations—with lower and lower costs.

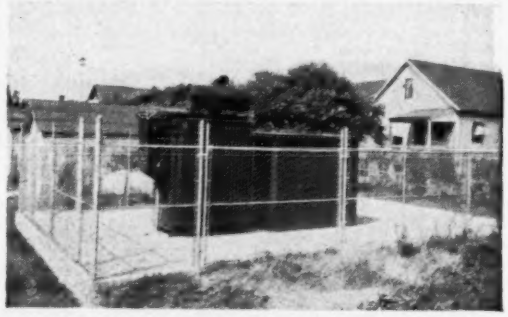
** G-E unit substations are now being built repetitively from standard components for almost any application you may have. Ask your G-E representative for Bulletin GEA-3800, or for a detailed presentation of our complete line in the light of your specific problem. General Electric Company, Schenectady, N. Y.*



1000-kva unit substation—Cat. No. US2A1



1500-kva unit substation—Cat. No. US3A2



3000-kva unit substation—Cat. No. US5NE4

GENERAL ELECTRIC

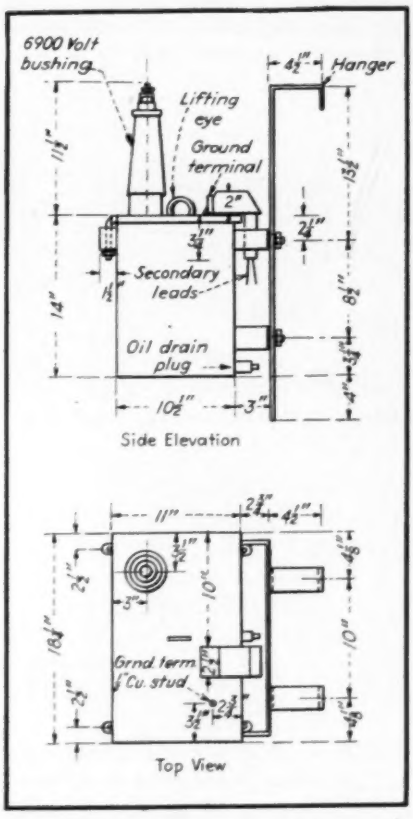
UNIT SUBSTATIONS

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

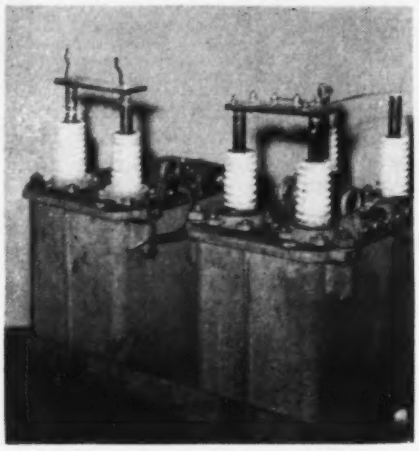
HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Convert Indoor P.T.'s for Outdoor Use

A $5 bushing and some labor avoided the purchase of new outdoor-type potential transformers by the Oklahoma Gas & Electric Company recently when the reclamation department rebuilt a number of surplus indoor potential transformers for outdoor use. The indoor transformers are shown, before rebuilding, in the accompanying illustration. Details of the rebuilt transformers are illustrated in the drawing.



DETAILS of outdoor potential transformers after conversion



TYPICAL 13,800–115-volt indoor transformers before conversion

Transformers that were rebuilt were 13,800-115-volt units and were operated with their high-potential coils connected in series. In arranging these for 6,900-volt grounded neutral operation the high-potential coils were connected in parallel.

A new transformer cover, made of ¼-in. steel, was substituted for the original. On it was mounted a single 6,900-volt, post-type, porcelain bushing using an adapter flange made from a piece of 2½-in. O.D. extra-heavy pipe. Since the converted transformers were to be used on a 6,900-volt grounded neutral system only a single bushing was required. The ground connection was made to a ½-in. copper stud on the cover.

Secondary connections were brought out, as shown in the drawing, through a sheet metal hood shaped like an inverted J and welded to the cover. Leads are compounded into this hood to prevent the entrance of moisture.

Two strap-type hanger supports were welded to the transformer case and drilled to take conventional transformer hangers. Slots are also provided in these straps to permit through-bolt mounting on the pole if desired.

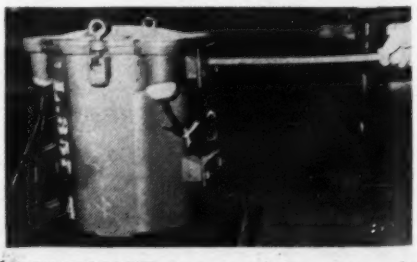
All material used in making the conversion of these transformers was taken from scrap. Only new apparatus required was the single 6,900-volt bushing mentioned.

•

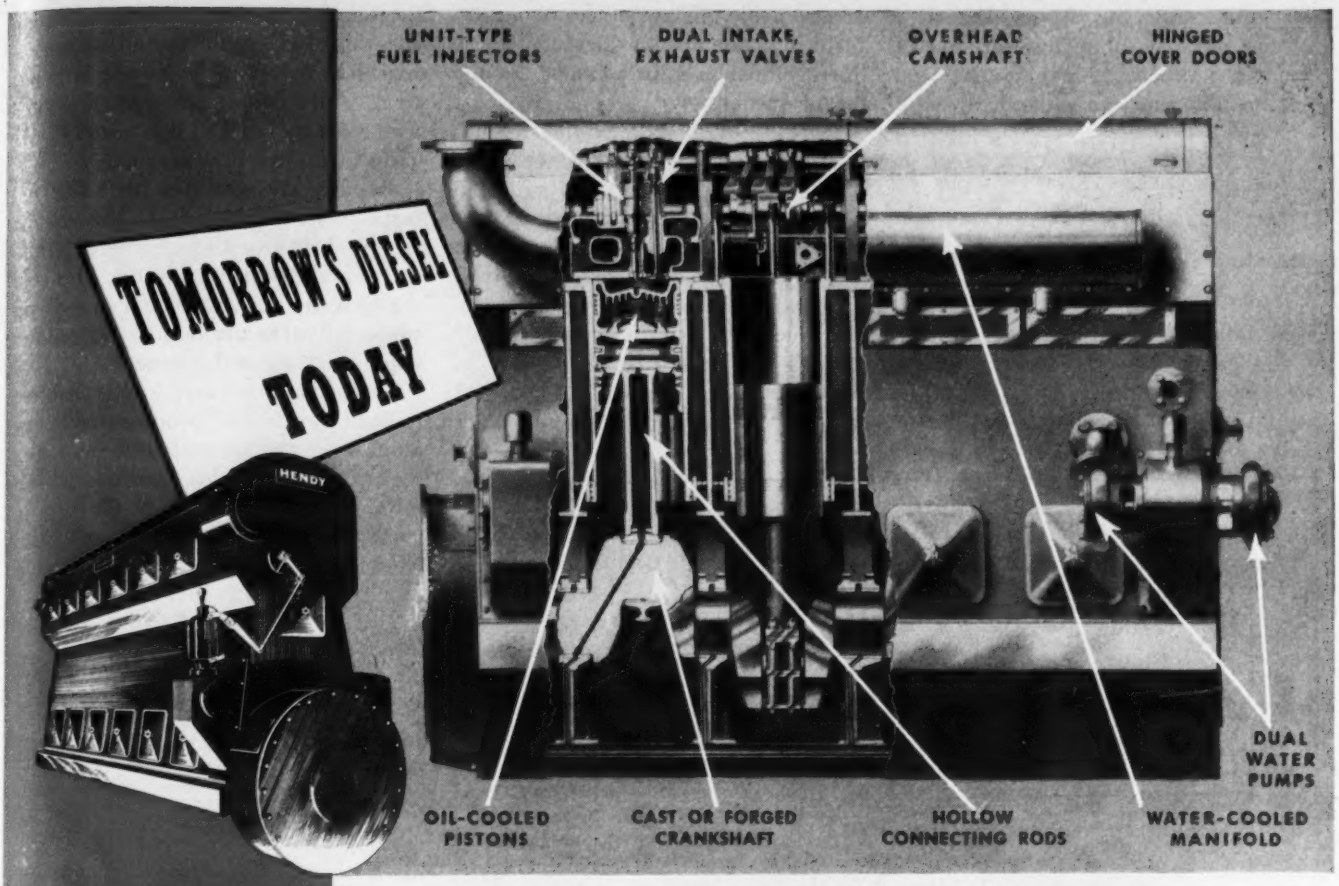
Steel Plate Replaces Hanger Irons

Pieces of scrap steel plate are utilized by the Washington Water Power Co., Spokane, for making hanger and heel plates for mounting distribution transformers. A "U"-shape slot for the through-bolt is burned in the piece of plate with a burning torch and holes are drilled for the bolts that fit into the transformer lugs. For transformers larger than 5 kva., the heel plate has a lag-screw slot also.

Supporting transformers by a single through-bolt and these hanger plates eliminates the conventional transformer hanger irons. Cost is not only less, but critical steel is saved as well. Moreover, no crossarm is required with this type of con-



TRANSFORMER hanger plates are made from scrap steel plate with burning torch during spare time of warehousemen



GENERAL SPECIFICATIONS
SERIES 50

Bore—12"; Stroke—15"
Speed—350 to 600 RPM
Rated Power at 450 RPM—
75 hp. per cyl.

Write for complete data on the Hendy Series 50 Diesel Engine

Only HENDY DIESELS
Combine all these features...

For the first time, 22 important design and construction features are combined in a single engine—the Hendy Diesel. Each makes a substantial contribution to low-cost operation or longer engine life. More than a half century of power-plant experience — plus expanded facilities — gives Hendy unusual ability for volume production of these new Diesels.

In addition to the features illustrated, Hendy Diesels have positive, full-automatic lubrication...controlled cooling system ...mechanical or hydraulic governing...centrifugally cast, babbitt-lined, steel-backed bearings...and centralized controls. Before you invest in any Diesel—be sure to look at Hendy's. For simplicity—long life—for modern design—look to Hendy.

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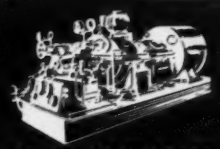
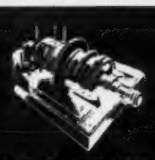

TURBO-GENERATORS

REDUCTION GEARS


STEAM TURBINES

DIESEL ENGINES

struction. The burning and boring of the plates is done by warehousemen in spare time, making the cost of the plates practically nil.

•

Field Sheath Repairs on Over-Age Cables

A number of operating utilities have found, during the war, that their older lead-sheath cables are developing sheath cracks. Normally this would lead to immediate installation of new cable. Shortages, however, are fostering attempts to sustain these damaged cables a little longer, by one means or another.

On the Columbus & Southern Ohio Electric Co. system discovery of sheath damage during the present period sets in motion a routine field procedure which has proved effective in repairing 500,000-cir.mil solid-type paper and lead 40-kv. single-conductor cable.

Old cable cannot be bent safely so it is first pulled out of its duct and straight on into an unoccupied duct across the manhole. As it emerges, every foot of length is carefully scrutinized to determine if repair is practical. Unless whole portions of sheath are seriously cracked it is usually possible to restore it to service.

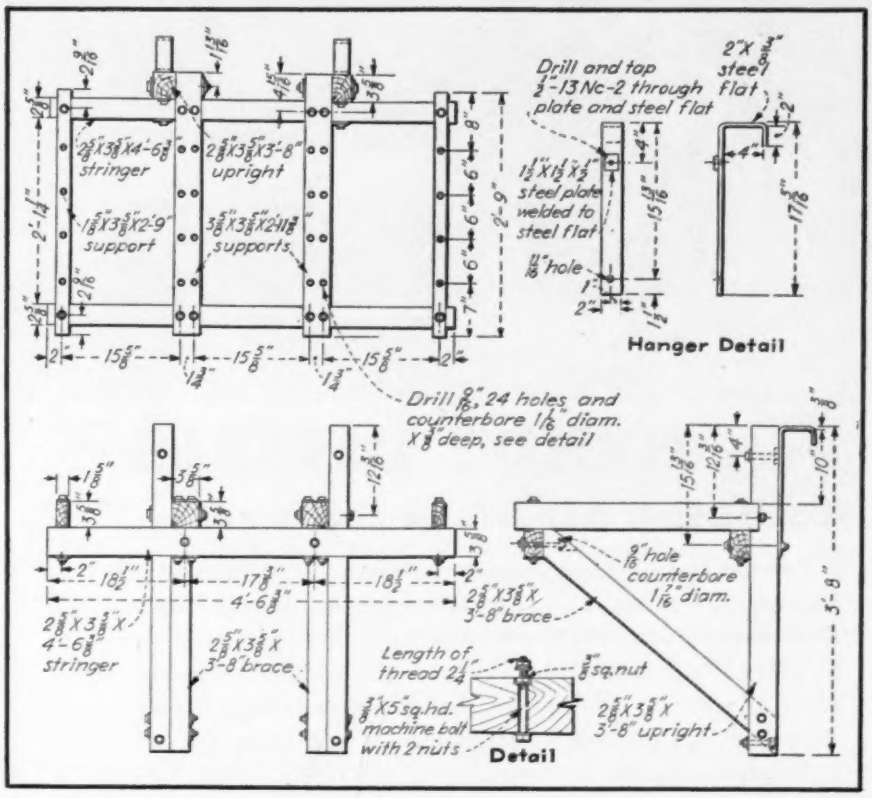
Repairs are made as the cable returns to its original duct. The sheath is first cleaned with kerosene or other solvent and surface grease and oil wiped away. Cracks in the sheath or suspected areas are built up by solder wiping in the usual manner.

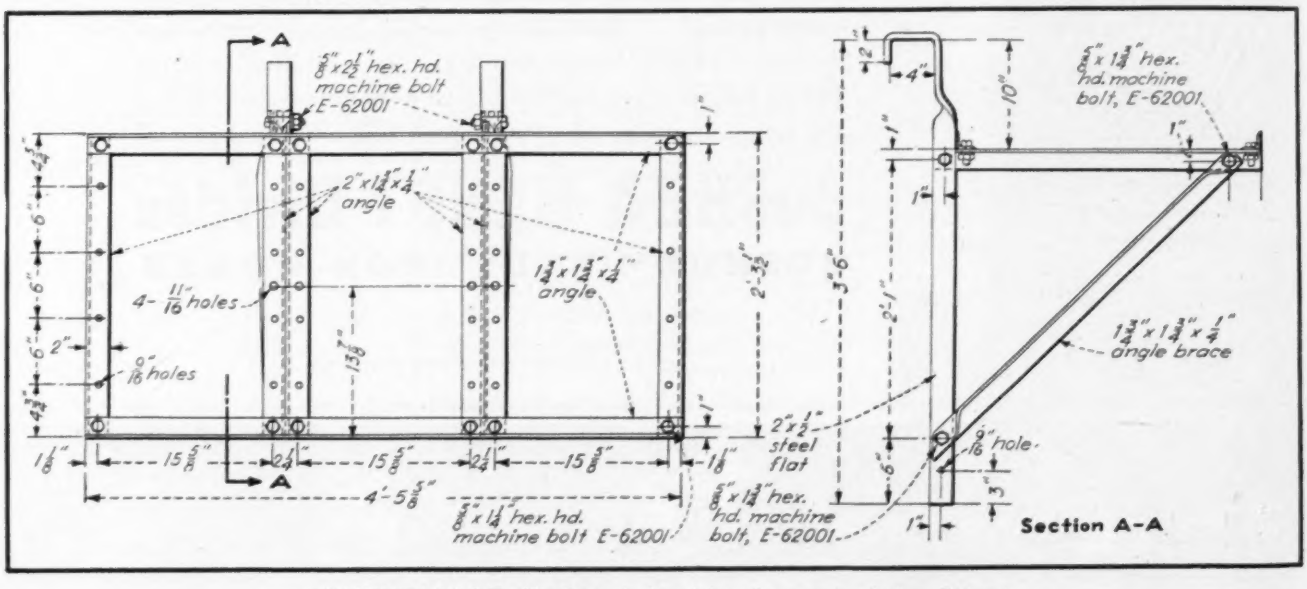
Cleaned and restored in this fashion most of the "leaky" over-age cable examined on the Columbus system has been given a new lease on life which should carry it through until new cable can be purchased. None of the lengths of cable so repaired have failed in service to date.

•

Capacitor Racks for Peace or War

Shown for comparison are both the pre-war and the present wartime design of pole-mounted capacitor racks used on the system of the Commonwealth Edison Company, Chicago. Both designs are intended to support twelve 15-kva. capacitor units—the only size used on the 4-kv. system. Both are also provided with hangers for crossarm mounting. The wood design is practically a redesign of the steel rack using creosoted Douglas fir instead of steel angles and strap. Company engineers report that about 25 of the wooden racks have been installed on the system to date.


Drill and tap ⅜-13 Nc-2 through plate and steel flat
2"X steel flat
Hanger Detail
Drill ⅝" 24 holes and counterbore 1⅛" diam. X ⅜" deep, see detail
2"hole counterbore 1⅛" diam.
Length of thread 2¼"
⅝" sq. nut
⅜"X5"sq.hd. machine bolt with 2 nuts
Detail

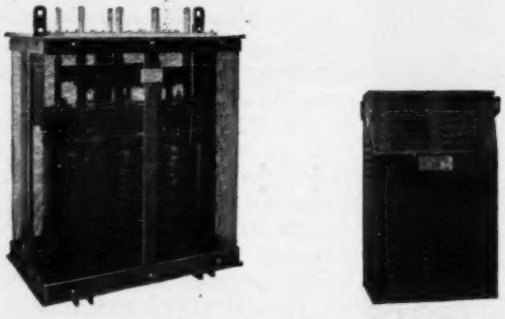


CAPACITOR RACKS: Wartime design (above), pre-war design (below)

MOLONEY AIR-COOLED TRANSFORMERS

For Indoor Installation *Without* Fireproof Vaults

600 Kva, 3-Phase Type BDL Air-Cooled transformer with Class B insulation. Rated 13800 volts delta primary to 460Y/266 volts secondary with 6-2½% taps available on terminal board located on side of transformer.



Left: 150 Kva Type BDL transformer. Type BDL is supplied in sizes from 150 to 1500 Kva in primary voltages from 480 to 13800 volts. *Right:* Type BDC. This type is supplied in sizes 15 to 100 Kva in primary voltages from 480 to 4800 volts.

It's Safe and Economical to Install Type BDL and BDC Transformers Indoors

THESE Air-Cooled transformers are insulated with approved Class B materials including glass, asbestos and porcelain. Since no cooling liquid is used, fire and explosion hazards are eliminated and Type BDL and BDC transformers may be safely installed at load centers without the expense of vault construction.

Because of the absence of a cooling liquid, there is practically no maintenance cost when using either Type BDL or Type BDC Air-Cooled transformers. There is no liquid to require periodic testing and conditioning. There are no valves, no gasketed surfaces, no cooling tubes or radiators to maintain.

Type BDL transformers are contained in expanded metal cases and Type BDC in louvered sheet-metal cases. Both types of cases are attractive in appearance and make the most effective use of cooling air for the particular design of the windings involved. Large cooling ducts are provided in the windings to permit rapid movement of a large volume of cooling air. The windings are designed to provide a maximum amount of coil surface for efficient cooling.

Moloney Air-Cooled transformers with Class B insulation may be used safely and economically in all industrial applications.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

SALES OFFICES

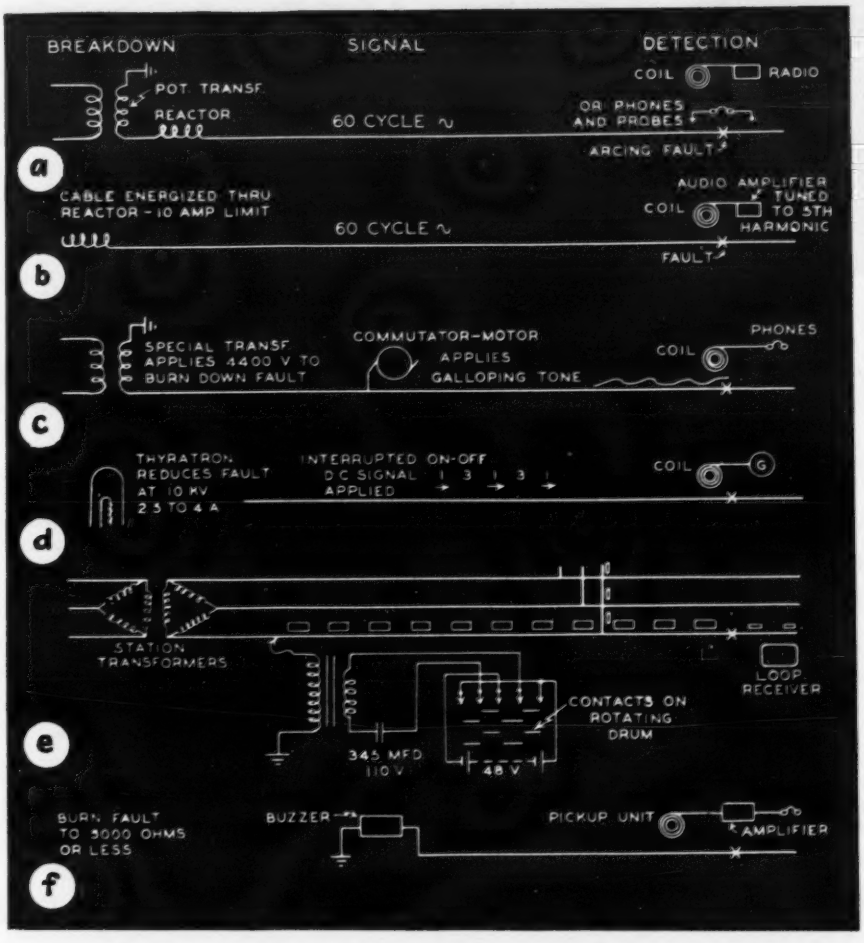
Alexandria, Va.....401 Doniphan Bldg.	Detroit, Mich.....{16125 Grand River Drive 744 New Center Bldg.	New York, N. Y.....55 Liberty Street
Atlanta, Ga.....217 Whitehall St., S. W.	Grand Rapids, Mich.....412 Houseman Bldg.	Omaha, Nebr.....503 Sunderland Bldg.
Birmingham, Ala.....1814 First Avenue, North	Houston, Texas.....4411 Navigation Blvd.	Pittsburgh, Pa.....837 Oliver Bldg.
Bluefield, W. Va.....201 Union Street	Indianapolis, Ind.....909 Roosevelt Bldg.	Portland, Ore.....1233 N. W. 12th Avenue
Boston, Mass.....Statler Office Bldg.	Kansas City, Mo.....624 Dwight Bldg.	St. Louis, Mo.....5390 Bircher Boulevard
Charlotte, N. C.....124 Brevard Court	Knoxville, Tenn.....716 Fairmont Blvd.	Salt Lake City, Utah.....314 Kearns Bldg.
Chicago, Ill.....100 West Monroe Street	Los Angeles, Calif.....124 W. 4th St.	San Francisco, Calif.....420 Rialto Bldg.
Dallas, Tex.....709 Thomas Bldg.	Minneapolis, Minn.....521 Midland Bank Bldg.	Seattle, Wash.....532 First Avenue, South
Denver, Colo.....612 Insurance Bldg.	New Orleans, La.....428 Balter Bldg.	Shreveport, La.....630 Spring Avenue

FAULT LOCATION ON NON-METALLIC SHEATH CABLES

By H. N. EKVALL, Engineering Department, Philadelphia Electric Co.

The Communications Committee of the Pennsylvania Electric Association at the request of the Electrical Equipment Committee recently undertook a study of various methods for locating faults in non-metallic sheath power cables and control wiring. A brief resumé of this study places the various fault locating methods into three groups. The first group is presented here and Bridge Methods and Miscellaneous Methods will follow in subsequent issues.

GROUP I—ELECTRIC PICK-UP METHODS



SCHEMATIC DIAGRAMS show methods of breaking down faults, kinds of signals to be applied and equipment for detection of signals

(a) STEINBACK ARCING METHOD—Fault broken down by potential transformer and current limiting reactor. Sufficient voltage applied to cause arcing at fault. Detection by radio or phones with probes.

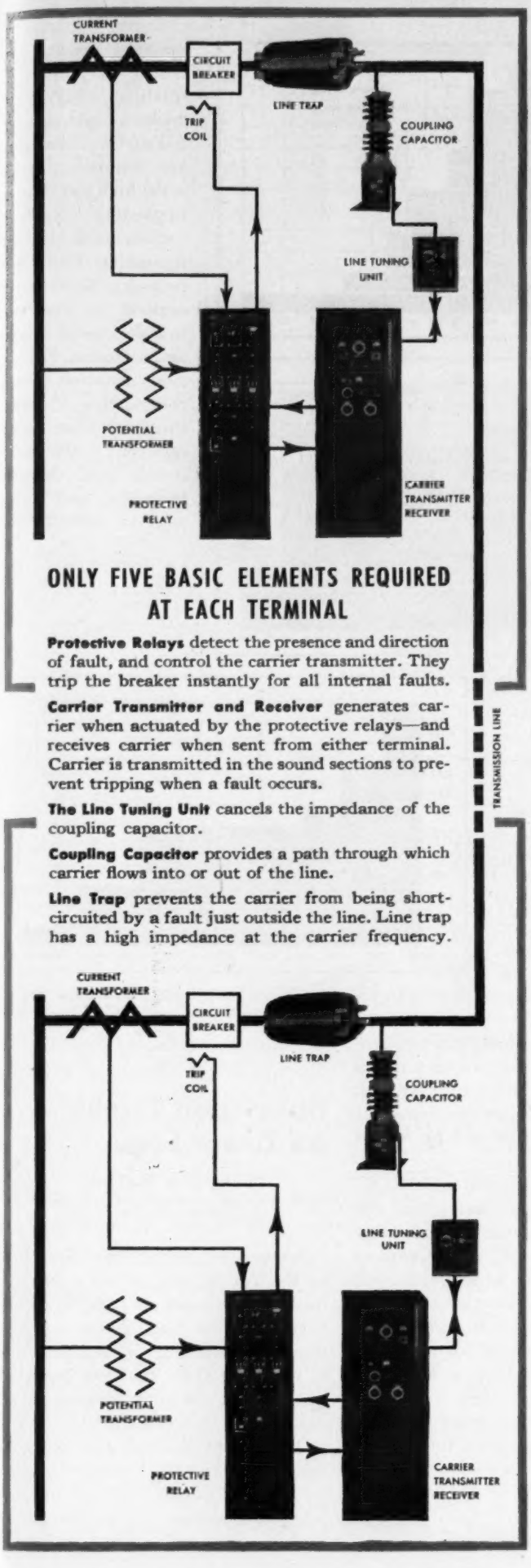
(b) TUNED ELECTROMAGNETIC GROUND LOCATOR—Fault energized through reactor. Capacitance effect of fault to ground increases harmonic component which is detected by portable detector coil and three tube amplifier tuned to 5th harmonic. Signal decreases sharply away from fault.

(c) LUNDIN LOCATOR—Fault broken down to low resistance. 110-volt signal applied by commutator. Detection by ear phone and exploring coil. Sometimes signal detection beyond fault causes difficulty. Station type equipment not readily portable.

(d) D.C. THYRATRON—Four tubes in full wave rectification supply 10 kv. to reduce fault to low resistance. Interrupted d.c. signal applied. Detection by exploring coil and galvanometer with readings reversing beyond fault. Station type equipment not readily portable.

(e) CAPACITY DISCHARGE LOCATOR—Developed originally for aerial lines, but suggested for trial on cables. Impulses generated by large condenser stepped up by transformer to line. Fault broken down by impulses and detected by loop receiver.

(f) BUZZER TONE METHOD—Fault resistance to ground should not exceed 5,000 ohms. Buzzer audio frequency tone signal impressed. Detection by portable magnetic pick-up unit and audio frequency amplifier with phones. Equipment readily portable.



ONLY FIVE BASIC ELEMENTS REQUIRED AT EACH TERMINAL

Protective Relays detect the presence and direction of fault, and control the carrier transmitter. They trip the breaker instantly for all internal faults.

Carrier Transmitter and Receiver generates carrier when actuated by the protective relays—and receives carrier when sent from either terminal. Carrier is transmitted in the sound sections to prevent tripping when a fault occurs.

The Line Tuning Unit cancels the impedance of the coupling capacitor.

Coupling Capacitor provides a path through which carrier flows into or out of the line.

Line Trap prevents the carrier from being short-circuited by a fault just outside the line. Line trap has a high impedance at the carrier frequency.

DELIVER MORE KWH OVER YOUR LINES

with high-speed Carrier Relaying

Increased loading and interconnection of power systems to serve heavy wartime loads have greatly multiplied the problems of relay protection. To maintain system stability and permit increased loads to be carried safely, requires rapid and selective clearing of faults.

By use of carrier channels for relaying the time delays normally encountered in conventional relay systems can be eliminated. It is possible to secure the full value of modern high-speed relaying over 100% of the line length.

Thus load capacity of the system may be substantially increased—in some cases as much as 50%.

Carrier relaying is simple in application and uses a minimum of critical materials. Westinghouse equipment may be ordered to cover a wide application field. Your Westinghouse office is equipped to give valuable engineering assistance on any application. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. J-95089

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Electronics at Work

How to Test Insulating Materials*

9—Physical Tests

By J. A. PETHO
Continental-Diamond Fibre Co., Newark, Del.

Electrical insulating materials of the plastic type are invariably subjected to mechanical loading, which does indicate that the material must possess physical strength in addition to its dielectric qualities.

To measure the physical strength different test methods were devised which are accepted as standards in determining the mechanical characteristics of the material. Standard test methods have been formulated by the American Society for Testing Materials and the most common of these tests are:

1. Tensile test—A.S.T.M. D48, D202, D229, D348, D348, D619, D368, D651.
2. Compressive test — A.S.T.M. D48, D229, D348, D349, D619, D649.
3. Bend or flexural test—A.S.T.M. D48, D229, D349, D614, D650.
4. Impact test—A.S.T.M. D48, D256, D619.

Tests not so frequently used are:

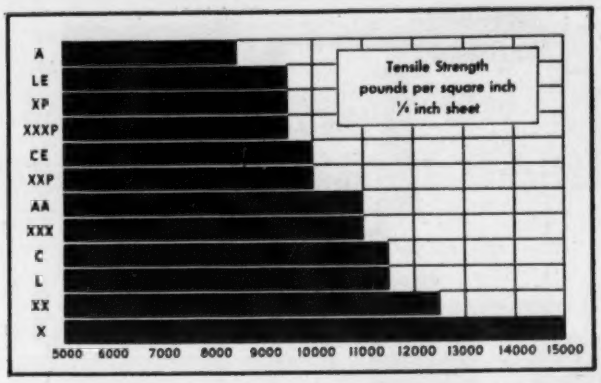
1. Fatigue properties — A.S.T.M. D671.
2. Bearing strength.
3. Shear strength.

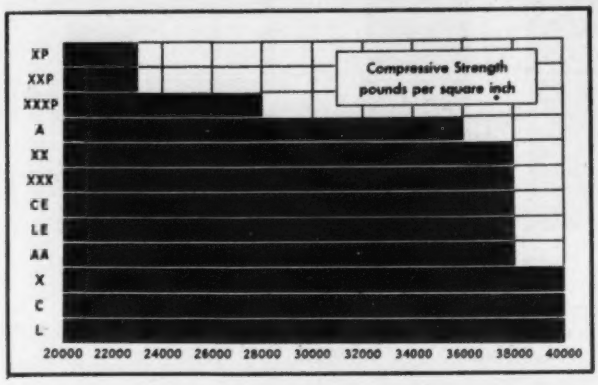
Preparation of test specimens is important, especially if conditioning before test is specified. Conditioning is usually at a specified relative humidity and/or temperature for a specified time, depending upon the type and thickness of the material (A.S.T.M. D618).

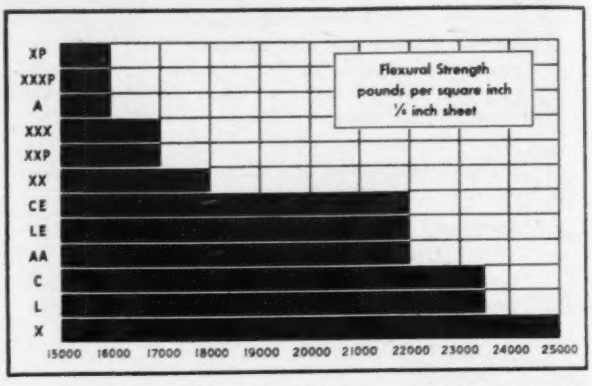
Testing is conducted in any of the standard testing machines, which are calibrated so that the error for the indicated loads does not exceed one percent. These machines are manually or automatically controlled and the rate of loading is the rate of travel of the movable head.

The first five tests listed above have A.S.T.M. designations, to which reference may be made for test procedure. Methods for determining modulus of elasticity, bearing and shear strengths follow.

Modulus of elasticity of the material is determined by either of the tensile, compressive and bend tests. In this case either elongation, compressive or bending movements are measured by a suitable dial gage and the modulus of elasticity in psi. is calculated by a standard formula.







SOME PHYSICAL CHARACTERISTICS for various grades of laminated phenolic insulations

Bearing strength of plastics is determined by several methods, of which the following is representative. Hardened steel pins are inserted through holes of the same diameter in the plastic test plate. The assembly is put in a jig and loaded. The bearing strength is determined from stress-strain data at a total deformation of 4 percent of the pin diameter.

Shear strength of plastics can be determined by a jig similar to the one used for the determining of bearing strength; however, there are various types in use at the present time, but the results obtained on these fixtures are closely related. By one method the test specimen is a round bar machined from a sample having a length of twice the diameter plus $\frac{1}{8}$ in. The specimen is inserted through holes, of the same diameter, in three metal plates. The load is applied to the metal plates until rupture of the test specimen.

A number of factors will influence the test results obtained on plastic insulating materials, thickness, temperature and surface conditions are definitely related to the final test results. Regarding surface conditions, for the optimum test results it is necessary to have the surface of the test sample free of cracks and scratches. For various materials the accompanying curves show the relationship between thickness, tensile and flexural strengths and influence of temperature.

*Concluding this series of articles, which began in "Electrical World," Dec. 11, 1943, issue.

•

Substation Frame on Tower Legs

By D. B. McGuire
Chief Engineer, Rockland Light & Power Co., Middletown, N. Y.

Increased business brought about by the war recently forced a large industrial customer of the Rockland Light & Power Co. to make application for a doubling of its load. Since this load of 1,000 kva. was being fed over a 4-kv. circuit a distance of approximately 2.5 miles it was impractical to transmit double this load over the existing circuit. A number of solutions were investigated; all but one involved sizable expenditures of money, time and critical materials.

Vinylite

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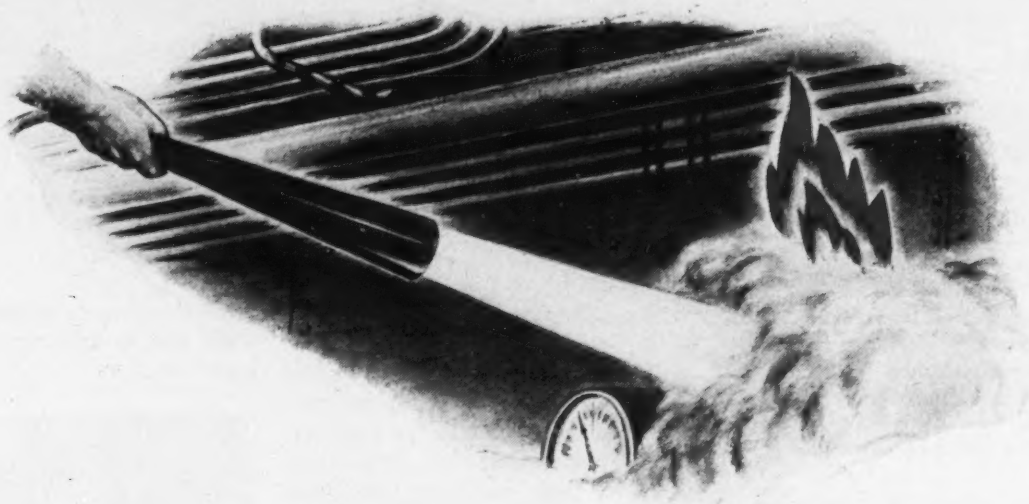

Flame Resistance *AN IMPORTANT INSULATION REQUIREMENT FOR YOU?*

Non-flammable wire and cable insulation may not be as vital on your installations as on a warship. But the insulation that has demonstrated this property in battle, and has come through, despite flame, corrosive brine, oil and grease, may be worth your careful consideration.

VINYLITE plastic wire and cable insulation will not support combustion. It is non-oxidizing, and highly resistant to abrasion. It is also resistant to acids, alkalies, oils, greases, and common solvents. It can be made in a wide variety of colors.

What do these properties mean to you? Insulation safety in central stations and industrial plants? More dependable insulation for power and lighting circuits? Oil and water-resistant portable cords? Easier identification of circuits? Write Department 28 for technical information on the properties, advantages, and broad range of usefulness of wire and cable insulated with VINYLITE plastics.

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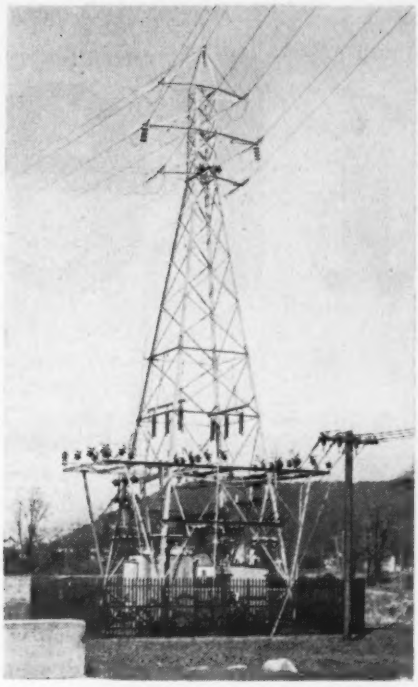


FIG. 1—Forty-degree tower on a 27-deg. angle has margin of strength to carry 6,000 lb. of additional structural steel and 5,000 lb. of switching equipment which, with the transformers between the legs, comprise the 2,400-kva., 33/2.3-kv. substation

The plan ultimately selected utilized a minimum of critical materials. It capitalized the proximity to the load of a 33-kv. double circuit steel tower transmission line. A 60-ft., 40-deg. dead-end angle tower located only some 300 ft. from the customer's main switch was chosen as the site for the new substation (Fig. 1).

It appeared most economical to locate the transformers and switch house within the enclosure of the tower legs. A design was evolved which met all company standards for clearances and safety of operation, testing and maintenance.

Two three-phase, 1,200-kva., 33,000-volt to 2,300-volt transformers were available which were altered to adapt them to the new conditions. This included reconnecting the low voltage side from 2,300 volts delta to 2,300/4,000 volts wye and providing taps below 33,000 volts for step-down use as taps above 33,000 volts had originally been supplied with the transformers for step-up purposes.

From an abandoned substation structure enough steel members were salvaged to mount the lightning arresters, fuses, buses, etc., on the tower. This was all fabricated on the job as it all had to be cut to fit.

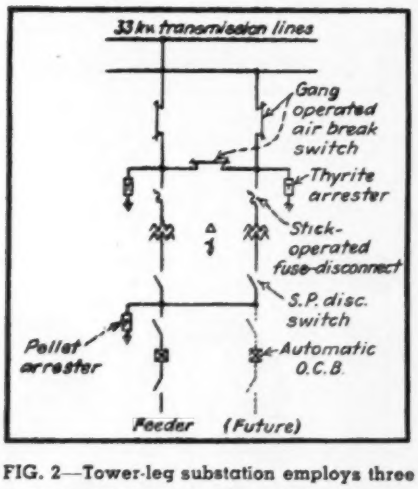


FIG. 2—Tower-leg substation employs three gang-operated air-break switches to tap either of two 33-kv. lines

Although company standards call for a steel-wire mesh fence, a wood picket fence was erected at the request of the War Production Board. The 4-kv. combined switchhouse and metering house was purchased new. It is equipped with an automatic reclosing oil circuit breaker, overload relays, meters and other miscellaneous devices ordinarily furnished in such an installation.

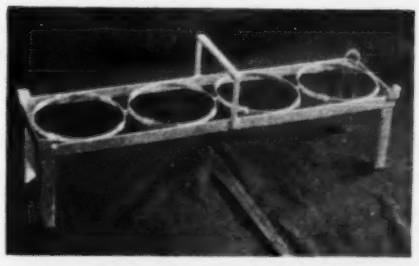
Provision has been made in the design for the addition of a second outgoing 4-kv. circuit with its switchhouse.

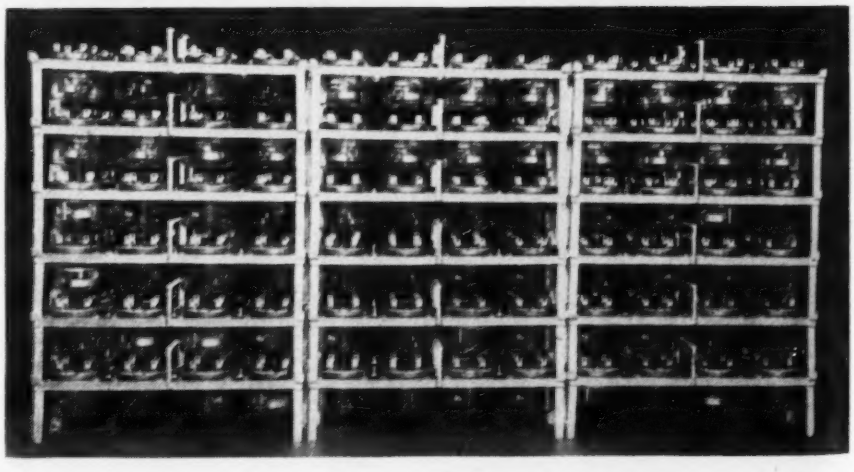
Great credit is due the field construction forces whose ingenuity made an installation of this character practicable.

• • •

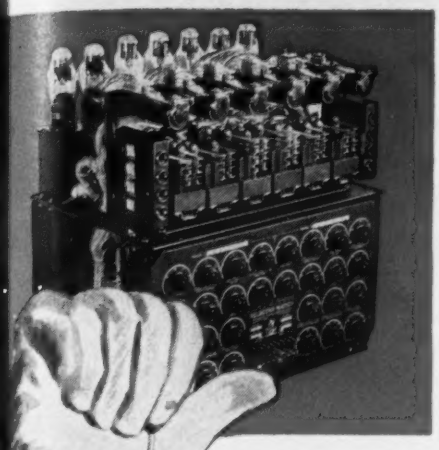
Socket Meter Carrier

Anyone who has ever tried to carry eight socket meters at a time will at once see the merit in the light metal meter carrier developed for the purpose by a Toledo Edison Co. engineer. Welded up on company shops from 1 x 1-in. angle and 1-in. strap iron, each carrier accommodates four meters. Two carriers can be handled with ease by one man. "Ears" at the top four corners of the unit permit loaded carriers to be conveniently stacked, as shown, in a comparatively small space. Support rings of the carriers are kept from marring the meter case by four small rubber bearing pads added to each ring.





How RCA Electron Tubes Direct Traffic!



The ELECTRO-MATIC*'s magic brain that helps fight "Sudden Death" is the group of 7 RCA electron tubes shown top rear: 2 full-wave high-vacuum rectifiers (RCA 6X5-G), and 5 thyratrons (RCA 885).*

THIS morning on your way to work you drove past "Dead Man's Corner." Few people still remember it as that. But the little Reilly girl whose father was the traffic cop there until they brought him home one night, dying... the mother of Dick Stone who drove the truck for Clark's...BenThompson's widow.**They'll* never think of it by any other name.

Today these danger spots are growing safe — through electronic devices like the "Electro-Matic" traffic regulator developed by *Automatic Signal Corp.*

Buried below the pavement at busy intersections is a sensitive magnetic detector coil that clocks traffic on each approaching highway and flashes the information to a master control center. Here, through the magic of RCA electron tubes, the volume, speed, and direction of traffic, spacing of vehicles, number of cars waiting, probabilities of arrival are all *automatically* analyzed and the one correct solution instantly put into operation through proper traffic light signals at each converging highway.

These control devices have reduced accidents substantially, cut down waiting time on the red light, and increased the capacity of overburdened intersections.

If your community could benefit from such a system, ask your local Safety Committee to get in touch with *Automatic Signal Corp., Norwalk, Conn.*

And if you believe electronics can do some counting, sorting, measuring, or control job in your industrial plant better, faster, or more accurately than by existing methods, write to us. We will gladly refer you to the equipment manufacturer best fitted to serve you. Or our tube engineers themselves may be able to help you—*for the Magic Brain of all electronic equipment is a Tube—and the fountain-head of modern tube development is RCA.* So merely write, stating your problem, to RCA, Commercial Engineering Section, 608 South 5th St., Harrison, New Jersey.

**Fictitious names, of course.*

BUY WAR BONDS

RADIO CORPORATION OF AMERICA

SAG AND TENSION TABLES FOR LONG SPAN AND RURAL DISTRIBUTION

By GEORGE R. PARKER, Chief Engineer, Electric Power Board of Chattanooga, Tenn.

Sag and tension values in accompanying tables are for stringing various sizes of bare copper conductors in spans longer than those normally encountered in urban distribution. These tables may be used in conjunction with data on selection of wood poles—see Electrical World, March 20, 1943, page 110, and October 16, 1943, page 82.

Stringing Sag, Feet, for Hard-drawn Copper Conductors. 350-ft. Ruling Span

Span Length, feet	Temperature, deg. F.						
	0	20	40	60	80	100	120
250	1.9	2.2	2.5	2.7	2.9	3.2	3.4
260	2.1	2.4	2.7	2.9	3.1	3.4	3.7
270	2.3	2.6	2.9	3.2	3.4	3.7	4.0
280	2.4	2.8	3.1	3.4	3.6	4.0	4.3
290	2.6	3.0	3.3	3.6	3.9	4.3	4.6
300	2.8	3.2	3.5	3.9	4.2	4.6	4.9
310	3.0	3.4	3.8	4.2	4.5	4.9	5.3
320	3.2	3.6	4.0	4.4	4.8	5.2	5.6
330	3.4	3.8	4.3	4.7	5.1	5.5	6.0
340	3.6	4.1	4.5	5.0	5.4	5.9	6.3
350	3.8	4.3	4.8	5.3	5.7	6.2	6.7
360	4.0	4.6	5.1	5.6	6.0	6.6	7.1
370	4.2	4.8	5.4	5.9	6.4	6.9	7.5
380	4.5	5.1	5.7	6.3	6.7	7.3	7.9
390	4.7	5.3	6.0	6.6	7.1	7.7	8.3
400	5.0	5.6	6.3	6.9	7.4	8.1	8.8
410	5.2	5.9	6.6	7.3	7.8	8.5	9.2
420	5.5	6.2	6.9	7.6	8.2	8.9	9.7
430	5.7	6.5	7.3	8.0	8.6	9.4	10.1
440	6.0	6.8	7.6	8.4	9.0	9.8	10.6
450	6.3	7.1	7.9	8.8	9.4	10.2	11.1

Tension Data, Pounds, Bare Conductors

Loading	Size of Conductor								
	6	4	3	2	1	1/0	2/0	3/0	4/0
No. Load [a]	230	365	460	590	745	945	1190	1500	1885
Medium [b]	745	985	1140	1340	1560	1840	2175	2600	3125
Heavy [c]	1055	1360	1570	1825	2090	2420	2825	3330	3960

[a] For a temperature of 60 deg. F.
[b] With an ice and wind load and at a temperature of 15 deg. F.
[c] Same as [b] except at a temperature of zero deg. F.

Tables are based on a ruling span of 350 ft. but longer spans can be sagged provided the average span for the section is less than 350 ft. Where spans longer than 350 ft. are isolated by deadends or where the average span for the section exceeds this figure, special sags will be furnished.

Sag values given in this table are such that conductors larger than No. 6 will meet the requirements for grade B construction with medium loads. Requirements in the past have established the practice of shortening the span length at railroad crossings and stringing the conductors so as not to exceed 50 percent of the breaking strength when loaded. This practice should be continued by keeping crossing spans with No. 6 less than 240 ft.

Where conductors are strung initially in spans from 250 to 400 ft. in accordance with these sags, the spans can be later shortened by insertion of intermediate poles and the resulting sags in the shortened spans will correspond to the values for urban construction (Electrical World, March 4, 1943, page 92). The tension in these shortened spans will be approximately two-thirds of that in the longer spans, making it necessary to guy against the long span construction unless additional conductors are strung in the short spans which would offset the unbalance in tension.

Clearances—Conductors will assume a permanent set and greater sag after medium loading is applied. Clearances to obstacles, therefore, should be based on sags given in the table plus 15 percent for No. 4 or larger conductors, and 30 percent for No. 6 conductors.

Compressed Air for automatic control

The increasing application of pneumatic control is recognition of its many advantages—reliability, simplicity, safety, and ease of maintenance. Automatic pneumatic control is one of the cornerstones of continuous processes, and without it many process industries could not operate.

Here is another striking example of the utility of compressed air power. It may suggest to you a means of solving many of your problems by applying air—the power medium for countless jobs which cannot be done as well, if at all, by any other method.

Ingersoll-Rand has pioneered compressed air systems since 1871, always supporting and developing new and time-saving applications. Our engineers will be glad to cooperate with you. Ingersoll-Rand Co., 11 Broadway, New York, N.Y.

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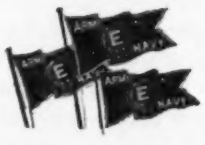

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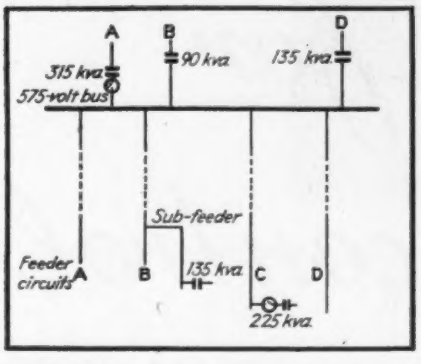
Subdivided Capacitors for Feeder Service

An outlay of $8,384 for capacitors in an Eastern industrial plant producing war materiel involving metal-working machinery and casting operations raised the over-all plant power factor from 78 to 94 percent under maximum load conditions, reduced the load per phase on the supply circuit from 2,650 amp. to 2,210 amp., improved regulation and cut the peak demand from 2,630 kva. to 2,180.



SCHEMATIC ARRANGEMENT of capacitors to divide corrective service in war industry plant

Power factor on certain internal distribution circuits was so low as to cause overheating of conductors and 900 kva. in Westinghouse capacitors was purchased for installation in segregated unit groups placed at strategic points. The diagram shows where the capacitors were installed.

Circuit A (serving foundry equipment)—Before correction the average power factor was 33 percent, the load being 119 kw., or 358 kva. at this low value. The feeders from the supply bus to the department were adequate for the existing load and 315 kva. in capacitors sufficed to raise this power factor to 95 percent. It was decided to locate these capacitors as a part of a group in the switchboard room, with provision for cutting the capacitors out at night to prevent over-correction under the light loads.

Circuit B (serving presses and other equipment)—Before correction the load totaled 430 amp. at 575 volts, with a power factor of 62 percent. A sub-feeder on this circuit was overloaded, 160 kw. at 65 percent power factor being noted, or 246 kva. and 258 amp. per phase. It was found that the installation of 135 kva. in capacitors close to the presses at the outer end of the sub-feeder circuit would raise the power factor from 65 to 95 percent, cutting the demand from 246 to 169 kva. and the amperes from 258 to 177. It was decided to install 90 kva. in capacitors in the switchroom group. Provision was made to leave the 135 kva. in circuit at night continuously to help improve conditions in the switchroom.

Circuit C (feeder for plant section showing overheated conductors)—Here the load was 755 amp. at 73 percent power factor. By installing 225 kva. in capacitors the power factor was raised to 89 percent, reducing the current from 755 to 620 amp. for the same kilowatt load. The capacitor units were installed at the end of the feeder farthest from the supply bus and the heating of conductors was reduced 33 percent (dropping as the square of the current). This capacitor is cut out at night.

Circuit D (special product manufacturing)—Load read 365 amp. at 65 percent power factor. It was found that 135 kva. in capacitors would be required to raise the power factor to 87 percent. In view of the fact that this feeder was of ample capacity, it was decided to install the capacitor units in the switchroom.

•

Applications of Duplex Core Reactor

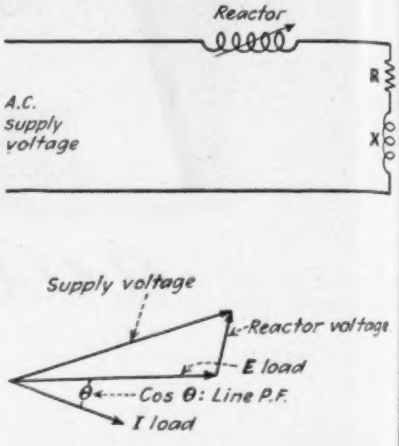
By E. C. WENTZ
Transformer Engineer, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Design fundamentals of a saturable duplex core reactor were outlined in ELECTRICAL WORLD, March 18, 1944, page 124. This article presents some applications of the new unit.

The saturable core reactor conceivably can be used in any kind of circuit in which a variable reactor is desired. The factors which limit its use are principally economic. Because the saturable reactor has d.c. coils as well as a.c. coils, it will cost about twice as much as a fixed reactor of the same kva. rating; thus, many of its possible applications are not economically practical. Some of its uses are discussed below:

1. Series Connection to Vary the Current in a Load of Approximately Constant Resistance—100 percent power factor—sketch—This is the most common application. The range of control for load voltage is commonly 10 to 90 percent of the supply voltage. To go down to 5 percent or up to 95 percent is practical, but either costs about 15 percent more. The reactance in the load circuit should be kept to a minimum. Even as little as 10 percent reactance (and this is still 99.5 percent power factor) means that 10 percent of the reactor voltage subtracts arithmetically from the load voltage (see vector diagram).

2. Series Connection to Maintain Constant Current in a Load of Variable Impedance—Although the circuit is the same, this application gen-



SCHEMATIC and vector diagrams for reactor when used to control load voltage. Top diagram indicates the load impedance. $R/Z = \cos\theta =$ Line power factor. $(E_{load} + E_x \sin\theta)^2 + (E_x \cos\theta)^2 = (E_{supply})^2$.

erally requires an expensive reactor. The reactor must be built large enough to absorb nearly full line voltage and carry full load current.

3. Shunt Connection for Use as a Loading Reactor.

4. Motor-Starting Reactor—If the allowable increments of motor-starting current are small, or if the starting current must be closely controlled, a saturable reactor is ideal. In this case the reactor will be much smaller and cheaper if it is designed for starting duty only, to be cut out after starting.

Small or large variable reactors can be used for countless special control applications where no other type of control works as well. It can be built in any size from 1 watt to 5,000 kw. Three-phase construction is also practical. The d.c. power required is usually about 1 percent of the a.c. power; thus, the control of large amounts of power is very simple and convenient.

The new type Westinghouse reactor utilizes asbestos-mica-glass (Class D, 80 deg. C. rise) insulation. This has

More and More He Relies on L-M Pole Line Hardware

Preference for L-M Pole Line Hardware has been increasing rapidly for many years, as indicated graphically by the growing size of the L-M lineman.

This is due to the fact that L-M Pole Line Hardware is designed for practical, long life service in the field . . . is conveniently packed for handling . . . just the kind of equipment that linemen have grown to rely on.

This record of quality and service has made L-M one of the largest suppliers of the Electrical Utility Industry for over 30 years.

For full information write to Line Material Company, Milwaukee, Wisconsin.

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POLE LINE HARDWARE

permitted a further reduction in physical dimensions. The new type construction, together with Hipersil steel and high temperature insulation, makes possible a reactor weighing about two-thirds as much as previous models. This saves a considerable amount of critical material.

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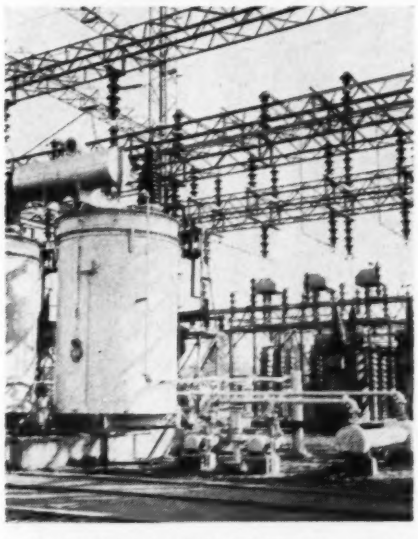
Forced Oil Cooling Ups Bank Capacity

By GEORGE W. KING
Consumers Power Co., Jackson, Mich.

Forced - oil - cooling equipment of special design was last summer installed on a 30,000-kva. bank of transformers that steps transmission voltage of 140,000 volts down to 7,500 volts at the Muskegon Heights substation of Consumers Power Company.

Before this cooling equipment was placed in service load on this transformer bank had reached maximums of 34,000 kva. At this loading hot oil temperature in the transformers reached values of 55 deg. C. With the cooling equipment in service, and loading approximately the same as before, hot oil temperature was reduced to a maximum of 45 deg. C. Studies have indicated that the equipment—installed in preference to a transformer bank of larger size—will increase the capacity of the existing bank to an estimated 50,000 kva.

Besides the 30,000-kva. bank mentioned, a second 15,000-kva. delta-connected, 60-cycle bank at this substation steps voltage down from 140,000 to 7,500. In addition there is a 30-cycle connection from a 75,000-volt line to the 7,500-volt, 60-cycle bus through a 12,000-kva. frequency changer operated as a synchronous condenser. This connection is used principally to supply rkva. demands. Power is also supplied at 22,000 volts by stepping up from 7,500 volts.



FORCED-OIL-COOLING SYSTEM on 30,000-kva. transformer bank drops hot oil temperature from 55 to 45 deg. C. at 34,000 kva. maximum loadings

Characteristics of the 30,000- and 15,000-kva. banks differ considerably since the smaller bank was designed for 30-cycle operation. As a result load division is not perfect and normal kva. ability of the two transformer banks, without overloading, was 38,200 kva.

Load growth studies indicated that an hourly demand of 48,500 kw., 55,000 kva. would be required in 1943 (actual demand in August was 45,000 kw.—52,300 kva.). They also showed that a substantial part of the increase in load would of necessity be supplied at 22,000 volts.

Design of the substation was such that a 33,750-kva., 140,000-22,000-volt transformer bank could be installed very easily and satisfactorily serve loads. This would require substantial amounts of critical materials, however, and further study showed that the 30,000-kva. bank of transformers could be increased to a rating of 50,000 kva. by the addition of forced-oil-cooling equipment and certain other minor changes in cables and current-carrying capacity. This has been done and resulting increase in capacity has been obtained.

Heat Exchanger

A standard water tube type heat exchanger was decided upon, having the water flowing in ¾-in. tubes and making two passes. Oil surrounds the tubes and makes one pass. To dissipate the heat generated in the transformers at the increased rating requires 150 g.p.m. of water through the exchanger in addition to 23 gal. through the regular cooling coils in each of the transformers. Rating is based on 25 deg. C. water.

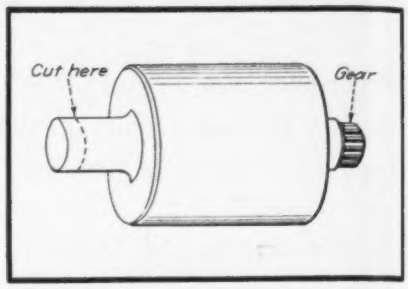
Transformers are connected to the heat exchanger by 4-in. pipe headers with suitable valves. Two circulating pumps are provided, only one being normally required. The slight inequality in the rate of oil pumped through each transformer, due to the difference in friction head in the piping to the transformers, is compensated by using the valves on the transformers nearer the pump to restrict the flow slightly.

Hot oil is pumped out of the tops of the transformer tanks (from a point between the main tank and the conservator) and cool oil returned at the bottom of the main transformer tanks. Cooling water is provided by a deep well. Temperature of the water is around 16-18 deg. C.

•

Sealed Clock Rotor Bearings Freed

Demand meter clock motors sometimes freeze in their bearings by coagulation of oil. If the rotor is of the kind that has a screw cap at the free shaft end of the drawn metal housing it is a simple matter to flush the bearings with a solvent oil and free the shaft in them. But some rotors have continuous housings; that is, no screw cap on the shaft end. The problem then is to open up the housing so the bearings can be flushed and to do it without damaging the assembly in the process.



SEALED clock rotor housing cut open to unfreeze bearings

In the meter shop of the Virginia Electric & Power Company this is done by cutting off the shaft end of the housing carefully in a lathe at about the point indicated by the dotted line on the accompanying sketch. After the bearings have been freed the housing is closed. This is done by inserting a snug-fitting brass ring into the end of the housing, leaving about half the width of the ring projecting to receive the cut-off piece. Before assembly the brass ring and the inner surfaces of the pieces to be joined were thoroughly cleaned so that solder will flow into the joint. A heavy soldering iron will hold enough heat to do the job. Then the outside of the joint is smoothed off and finished with emery cloth and the rotor is ready to go back into service.

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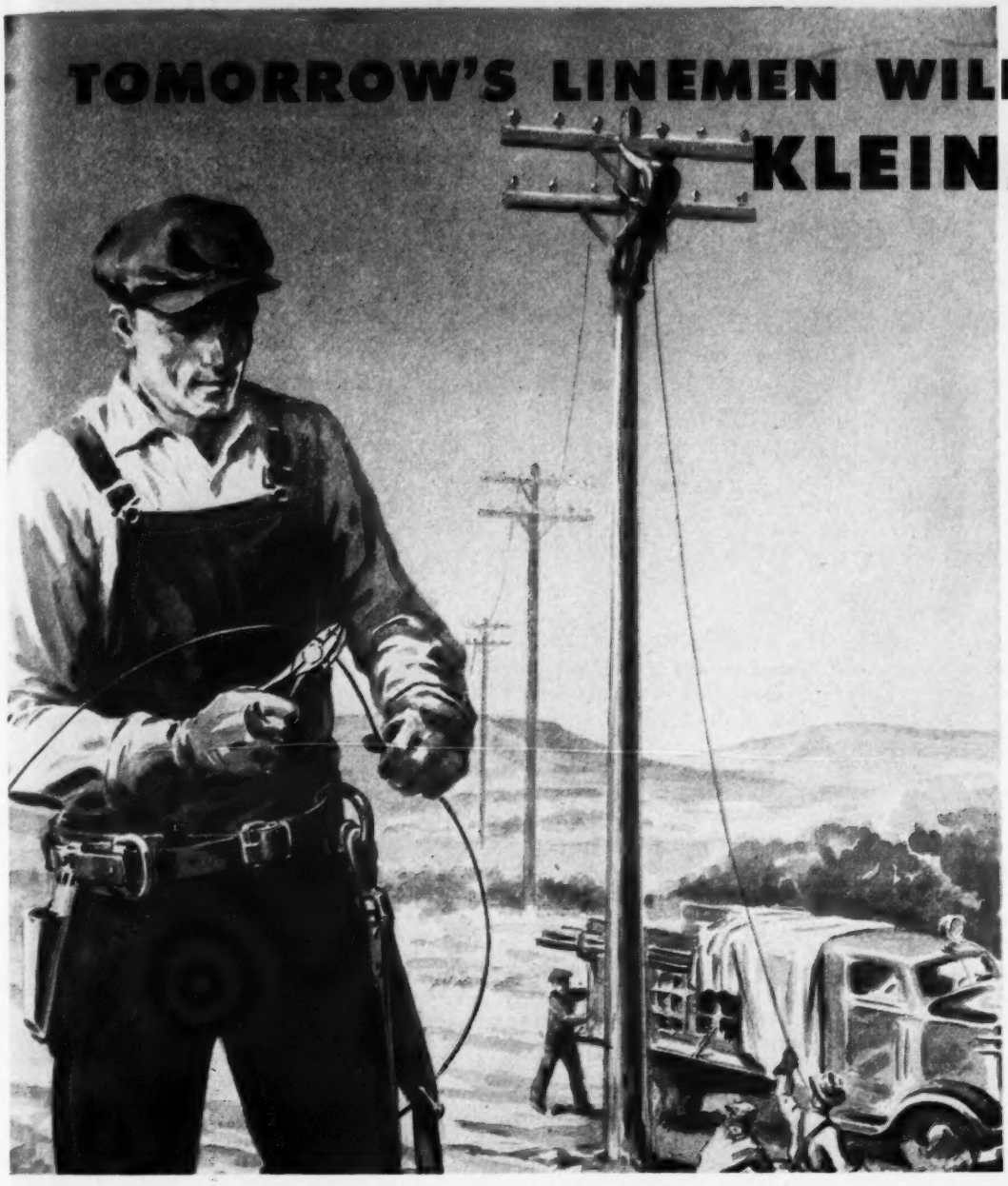

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HOW TO DETERMINE CAPACITY OF CHAINS AND WIRE ROPES

By JOHN L. SKEEHAN, Baden, Pa.

CAPACITY OF CHAINS

An old millwright method for determining the working capacity (tons) of a wrought iron chain was to square the number of eighths of an inch in the diameter of the link and divide the result by seven.

Take a ¾-in. chain for example. There are six-eighths of an inch in ¾ in. Then 6^2 divided by $7 = 5+$. Thus the working capacity of a ¾-in. chain is five tons.

Capacities determined by that method agree very closely with the figures for iron single sling chains (Chain Institute Standard, 1931). Comparing the values in that table with Proof and Break Test Loads (ASTM Specification A56-30) it will be observed that the safe working load is about one-third of the breaking load (factor of safety 3) and about two-thirds of the proof load.

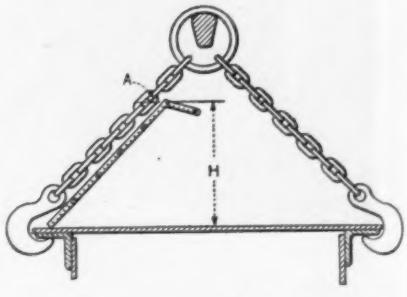
These loads will produce a tensile stress of about 11,300 lb. per sq. in. in the straight portions of the link, uncorrected for eccentricity of loading. There is a more or less generally accepted assumption that the ultimate resistance of a chain link averages about 1.63 times that of the bar from which the chain is made.

Other Safe Loading Values

Some authorities specify lighter loading than the safe loads determined by the method given above. The safety factor may be increased by using a figure larger than seven as the divisor.

However, with slingchains hooked up with the legs of the sling at an angle with each other, stresses are set up in the chain which will reduce the safe load lifting capacity. See sketch for method of determining safe capacities under this condition.

These loads are based on chain in good condition, without twists or kinks, and assuming that the links are protected against bending around corners of the piece lifted.



Example for a Chain Sling

Given—A ¾-in. chain is good for 5 tons in the direction of its length.
Solution—1. Measure off five joints of an ordinary 6-ft. rule (one joint per ton).
2. Place a chalk mark on the link at a point (A) opposite the end of the fifth joint of rule.
3. With the same rule measure the vertical distance (H) from the horizontal spread line to the chalk mark. The number of rule joints is the number of tons for which each leg of chain is good.
4. Suppose that the length (H) is 3½ joints. Each leg is good for 3½ tons vertical lift.
5. Load which may be lifted by two chains is seven tons.

CAPACITY OF WIRE ROPES

The same method may be used for closely approximating the working capacity of steel wire ropes on the basis of a safety factor of five, suitable for most services exclusive of the handling of hot metal.

For highest quality wire ropes of "Improved Plow Steel" or "Monitor Plow Steel," squaring the number of eighths of an inch in the diameter of the rope and dividing by eight gives the safe capacity in tons of 2,000 lb., factor of five.

For lesser quality wire ropes, such as "Cast Steel," "Crucible Steel" or "Plow Steel," use a divisor of ten. For iron wire rope use a divisor of 25.

It may be observed that the strength of a given quality and size of rope is affected by the construction. Based on 100 percent strength for 6x19 construction, 6x7 averages 86 percent, 6x37 about 95 percent, and 8x19 only 86 percent.

Strength of a given quality or construction of rope varies approximately as the diameter to the 1.95 power; to all intents and purposes, as the square of the diameter.

All capacities based on wire ropes in good condition, properly maintained and used fairly, without kinking or passing around sharp corners or over sheaves too small or not smooth.

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At the same time, the sources of supply of natural rubber have been cut off and available stocks have been reduced until rubber can be used only for purposes where no substitute can be found. It can no longer be used in sheath compounds for cable – and only in insulation for a very few types of cable where service requirements preclude the use of synthetic materials. Synthetic insulations and sheaths have replaced rubber compounds and the new materials have, in many instances, exceeded expectations both mechanically and electrically.

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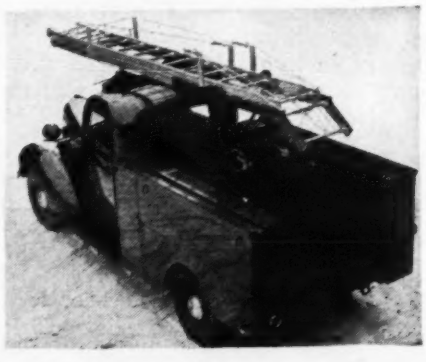
Here is a practical, easy solution of one of your post-war planning problems. Write, wire or phone for complete details.



THE American COACH & BODY CO.

PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

Traces Radio Noise from Bushing

By D. F. MEYERS
General Superintendent Kentucky & West Virginia Power Co., Ashland, Ky.

Radio interference radiating out from 6 to 10 miles from a 33-kv. substation so intense that it was practically impossible to obtain any kind of reception developed some time during March, 1943. After investigation and testing with the Tobe-Deutschman radio interference locator it developed that the trouble was coming from one of our 34.5-kv. condenser-type bushings installed in a transformer bank, consisting of three 333-kva. 33/6.9-kv. connected delta-delta. Tests made in the shop showed the interference started at 12 kv. It was then placed in storage until such time as further tests could be made to determine from what source this interference originated.

Tests on the Job

During July following it was possible to check this bushing with a standard Doble power-factor test set; no trouble whatsoever was observed. However, by using a radio in conjunction with the power-factor testing equipment it was noted that interference did show up, but not until the voltage applied reached 12 kv.

The various tests made were as follows:

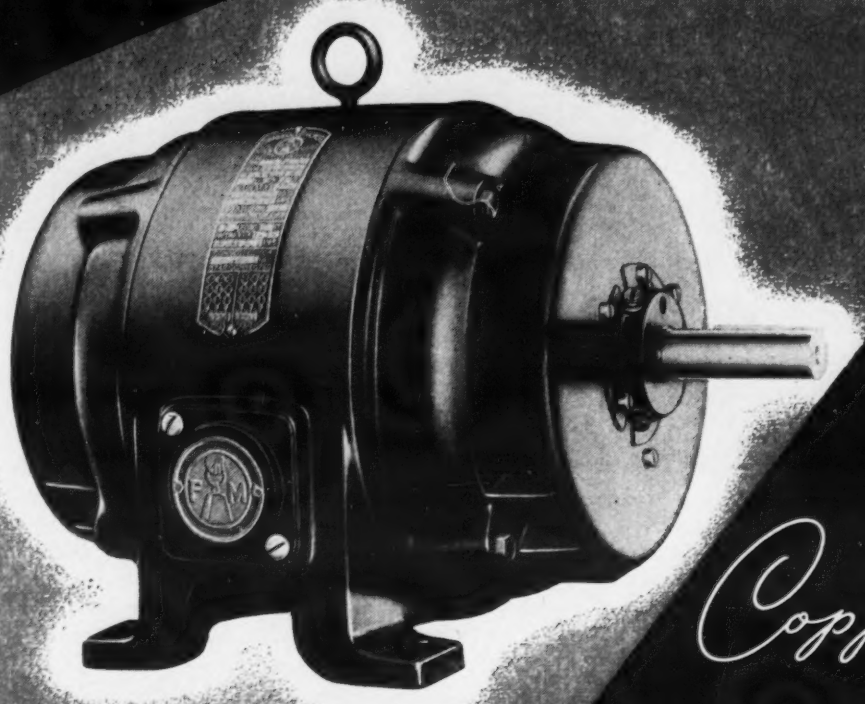
Hot collar tests were made with good results (*i.e.*, by placing a flexible copper strap around the porcelain between each skirt to check insulation value). There were no indications of cracked or porous porcelain, nor of water or voids in the compound.

Potential was then applied to the ground flange with the center lead grounded (standard Doble power-factor test in reverse) and at 12 kv. radio interference seemed to be greater than at 12 kv. with standard power-factor tests.

The bushing was then dismantled by removing the lead, top-cap, compound and porcelain weather casing, with power-factor tests applied at each step of dismantling.

Tests then applied to the remaining condenser stem showed the interference level as high as ever. Tests were also made with the collars attached to the shield circuit on both top and bottom sections of the stem in order to eliminate the possibility of

A Challenge to the Future ...in Motor Design



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- **It is a protected motor.**
- **It has an optional conduit box assembly.**
- **It has cross-flow ventilation.**
- **It has ball bearings—sealed in cartridge type closures.**
- **It has exclusive Fairbanks-Morse *COPPERSPUN ROTOR.***

Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

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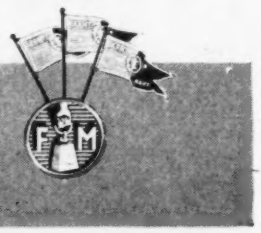
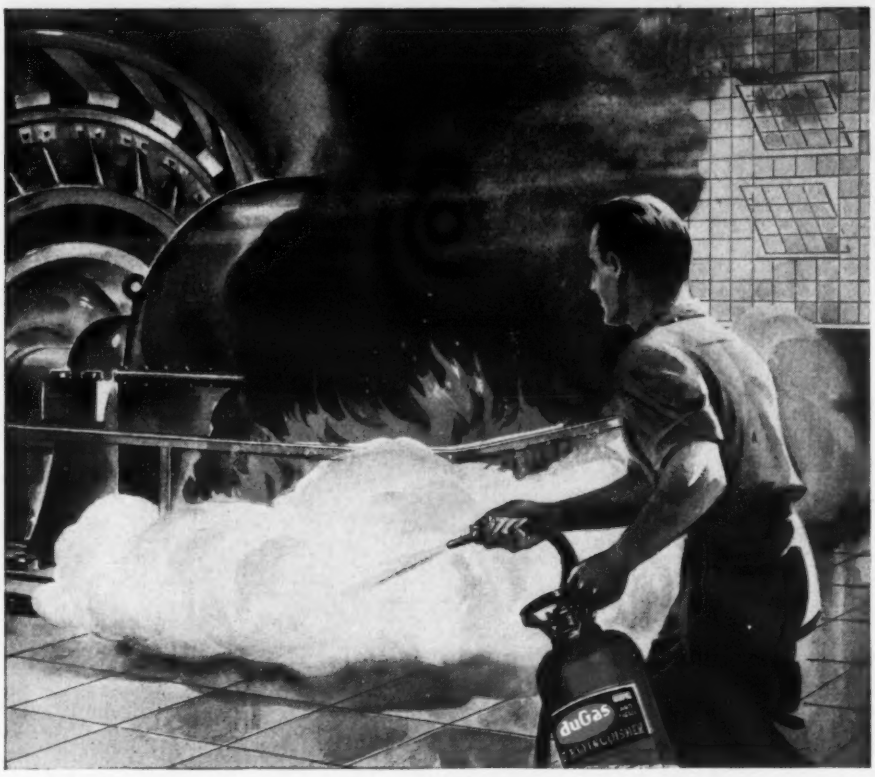
Motors





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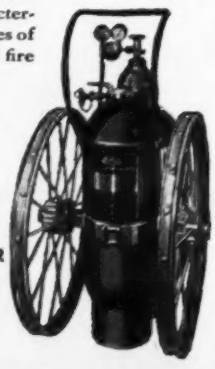

MODEL 150 WHEELED EXTINGUISHER

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surface leakage. This test also was without good results.

Bushing was then removed to a completely darkened room to ascertain whether or not creepage from the condenser stem to the main ground flange could be visually observed. However, no visual arcing was noted at 12.5 kv. (which is the maximum voltage of the test set). Although definitely noisy at this point, the bond between the brass mounting sleeve and main ground flange seemed to be in an excellent condition.

We were unable to make further tests by dismantling without factory equipment and it was decided to return the bushing to the manufacturer for further tests and study.

Tests by Manufacturer

When the bushing was received at the factory it was immediately sent to the high-voltage laboratory for radio interference tests as received. These tests showed quite a strong radio interference appeared when the applied voltage reached a value of 9 kv. (it will be noted this is considerably lower than tests made in the field). The porcelain weather casing was then removed from the condenser and the test repeated. As there was no filling compound inside the bushing the removal of the porcelain did not change the value of the voltage at which the radio interference began. Since it appeared the condenser was in fairly good condition, it was evident the interference was due to bad contact between the main flange and the ground layer of the condenser. In proving this to be correct the flange was rolled down and the former test repeated, resulting in the elimination of all interference whatsoever until the value of 20,000 volts was applied to the condenser. At 24,000 volts there were only 50 microvolts registered.

For a comparison a similar condenser was removed from stock and tested parallel with the former bushing, with the result that the stock condenser did not indicate radio interference at 30 kv. and at 35 kv. only 50 microvolts were observed.

As a result of this experience it is the writer's opinion that radio interference equipment should be co-ordinated with all Doble power-factor tests on high-voltage equipment in the field. It is very evident that the Doble test alone will not give us a true condition of equipment relating to radio interference, which has become quite

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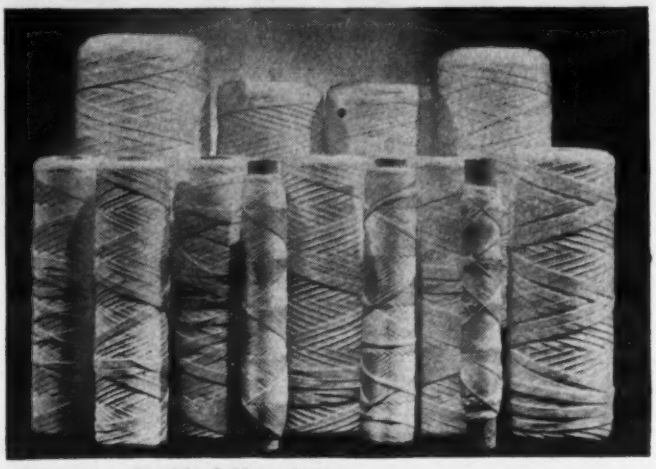

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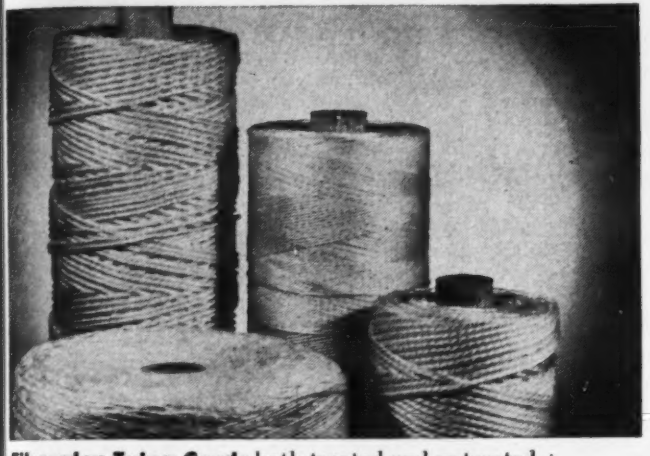

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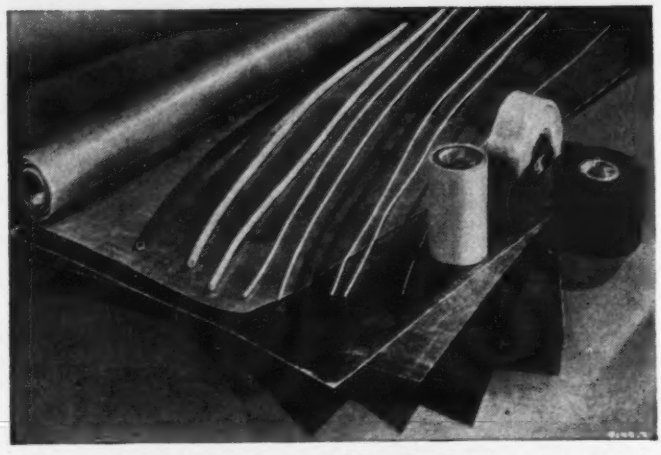

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RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES

a problem to locate and correct. I believe that considerable time, expense and interruptions can be avoided by co-ordinating these tests.

•

Pre-selective Control for Hydraulic Press

By adding a pre-selective pointer to a pressure gage and arranging a control circuit to be energized by contact between the pointer and the gage hand, the problem of precise control for a 50-ton hydraulic press was solved by Emerich Stern, a methods man at General Electric's Schenectady Works.

PRESSURE GAGE with pre-selective pointer

The press operates at 2,000 to 3,000 lb. psi. and is used to bend bus bars of assorted thicknesses and widths to various angles. It works at a three-stroke-per-minute cycle and is a semi-automatic type.

The pressure gage to which the pre-selective pointer was added is a standard type instrument with a 5-in. dial. When pressure is built up to the point where the gage hand touches the pointer the contact closes the circuit in an instrument contact-making relay. This energizes a 50-lb. pull solenoid which trips a spring mechanism on the valve, reversing the motion of the ram.

Releasing pressure by this method has certain advantages over the by-pass type of pressure control. Water loss is minimized. Selection of desired pressure or tonnage over the entire range of the cylinder's capacity is simple. Where oil at high pressure is used instead of water, the method eliminates heating of the oil caused by continuous by-passing through the valve.

UNIV. OF CALIFORNIA

THE SCENE: Lighting Conference

THE VOTE: MILLER Fluorescent—Unanimous

Lighting meetings like this have happened many times in the past in many a busy war plant—will happen many more times during crucial 1944. Inevitably the vote goes, hands down, to MILLER 50 & 100 FOOT CANDLERS, and here's why . . .

PLANT MANAGER—"We still have stiff production quotas to meet—with greener help. MILLER 50 & 100 FOOT CANDLERS will give us 30, 40, 50 or more foot candles of illumination—and that's what we need for better, faster production."

WORKER—"Sounds good to me. I've worked under MILLER fluorescent and I know I've worked better and felt better simply because I could see what I was doing at all times clearly and sharply."

MAINTENANCE MAN — "Those lightweight Masonite reflectors MILLER uses will take plenty of punishment, and yet a girl can handle their cleaning. I like the exposed ballasts because they mean cooler operation. And I go big for that MILLER Patented Safety Lamp Lock that keeps lamps from falling."

ELECTRICAL CONTRACTOR — "I can handle the installation of MILLER equipment in less time, shorthanded as I am for trained help. Units go together easily into self-aligned runs. Hanging is simplified. I've had MILLER jobs result in installation savings of 30 to 50% to owners."

ARCHITECT — "I've specified MILLER Continuous Wireway Fluorescent Lighting Systems on both new construction and modernization projects. The beauty of it is its flexibility. Whole sections, or even the entire system can readily be moved to other parts of the plant."

UTILITY ENGINEER — "From power source right through to controls, the whole MILLER setup saves considerable critical material—and provides an adequate, modern lighting system . . . something we utility guys have been preaching for years."

OWNER — "You fellows hit both my pocketbook and my patriotism. I say let's specify MILLER 50 & 100 FOOT CANDLERS—and let's get a MILLER field man in pronto to talk turkey."

THE MILLER COMPANY • MERIDEN, CONNECTICUT

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LOAD SERVICING

Industrial • Commercial • Rural • Residential

Georgia Power Plans for Freezer-Lockers

Large increase in the number of food freezer-locker plants in Georgia is to be anticipated after the war, if one may judge from plans being made by the sales department of the Georgia Power Co. to promote that class of business. The company recently held a two-day sales school devoted entirely to the subject, at which a manual entitled "How to Select and Operate a Freezer-Locker Plant Successfully" was presented and studied thoroughly.

The table of contents of the manual show its scope:

The Freezer-Locker Plant—pre-war, war-time, post-war; Number of Freezer-Locker Plants in the U. S.—by states; Map of Farm Population—by states; Georgia's contribution to the Freezer Locker Industry; List of Freezer Locker Plants in Georgia; List of Proposed Freezer Locker Plants in Georgia; The Kind of Freezer Locker Plants Georgia Needs; Government Regulations for Building Freezer Locker Plants; Digest of WFA "Requirements"; Priority Form Reference Chart; Complete WFA "Requirements"; Supplemental Information Form 40-R492; Locker Plant Finances; The Need for Engineering a Freezer-Locker Plant; Typical Floor Plans; Sources of Supply; Engineers, Contractors, Equipment and Supply Dealers; Operating Suggestions: Processing Fees, Records, etc.; Good Advertising and Public Relations; Processing of Vegetables and Fruits, by Dr. J. G. Woodruff, Georgia Experiment Station; Vegetables Suitable for Freezing; Vegetables Unsuitable for Freezing; Freezing Sweet Potatoes; Table 1—Freezing Vegetables, Freezing Eggs, Freezing Cooked Foods, Fruits Suitable for Freezing; Table 2—Freezing Fruits, Processing of Meats, Fish and Poultry, by Professor Hoyt Turner, College of Agriculture; Table 3—Freezing Meats; Packaging Frozen Foods, by Dr. J. G. Woodruff, Georgia Experiment Station; Thawing and Using Frozen Foods, by Dr. J. G. Woodruff, Georgia Experiment Station.

The manual concludes with a bibliography listing three books, three magazines and nearly sixty articles and institutional publications dealing with all phases of freezer-locker design and operation.

•

Tables on Rolls Speed Billing

By CHARLES E. FLAHIE
Electrical Distribution Dept.,
The Toledo Edison Co., Toledo, Ohio

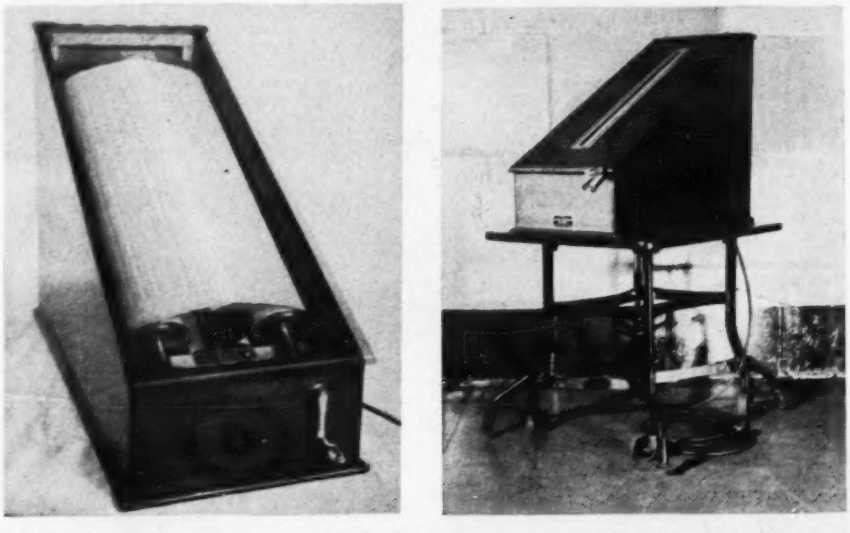
At the Toledo Edison Co. the mental gymnastics involved in calculating power bills have been reduced to very nearly the vanishing point by the "mechanical billing brain" shown. All that is required is to twirl a crank, peer through a slit in the cover, and read off the answer.

Over 300 power customers of the Toledo Edison Co. are billed on a two-part rate where the billing demand is a function of the maximum kilowatt demand for one hour and the average power factor for the same interval. Kilowatt and reactive demands are metered graphically.

Power factors and demands must be calculated from the meter charts. That's where the mechanical billing brain comes in. With one twist of the crank the product of a demand chart indication and the meter constant is obtained. Another twist yields the power factor corresponding to any two kilowatt and reactive components, all without computing the tangent and referring to tables for the corresponding cosine.

Reduced to its elements the billing brain is simply a device for the convenient handling of two large tables; one of products, the other of power factors. Both tables are printed on a single long linen strip. Any column of figures in either table can be rolled into a vertical viewing slot by turning a crank which runs part of the long table off the one cylinder and onto another. The device uses cylinders turned from wooden rollers, connecting chain mechanism from player piano parts.

Frame of the viewing slot is indexed vertically with 100 divisions corresponding to the graduations of a 1.0 kw. full-scale demand meter chart. One table has a column of products for each of 55 meter constants in common use. The other table—on another part of the linen



DEMAND and power factor tables used in power billing have been mechanized in "billing brain" used by Toledo Edison. Tables are printed on a linen strip rolled under a viewing slot between cylinders

*Rōmey says . . .

This is one of a battery of high speed drawing machines that are ready to serve you.

We welcome your inquiries for bare and weatherproof wire NOW.

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CLEVELAND 14, OHIO	DETROIT 2, MICH.

See Your Telephone Directory

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FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK

Although "Megger" testing instruments are sometimes referred to as "Meggers," there is actually no such thing as "a Megger." Why? Because the name "Megger" is a trade mark which is registered in the U. S. Patent Office and it applies in this country *only* to certain electrical instruments that are sold exclusively by the James G. Biddle Company. • These facts are re-stated here to prevent misunderstandings that may arise from careless or misleading use of the term "Megger." • The more widely used of these "Megger" instruments are listed below. Full information will be furnished on inquiry.

"Megger" Insulation Testers.....*Bulletin 1735-W*
"Bridge-Meg" Resistance Testers.....*Catalog 1685-W*
Midget "Megger" Testers.....*Bulletin 1690-W*
Midget "Megger" Circuit Testing Ohmmeters.....*Bulletin 1495-W*
"Megger" Ground Testers.....*Catalog 1645-W*
"Ducter" Low Range Ohmmeters.....*Bulletin 1635-W*

"MEGGER"
TRADE MARK REGISTERED U.S.PAT. OFF.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

strip—has a column of power factors for each of the 100 divisions on a 1.0 rkva. full-scale meter chart. Thus in the one case the product of the demand chart indication and the meter constant is had by turning to the column corresponding to the meter constant and reading the actual demand from the table opposite the demand chart indication on the viewing frame. To find the power factor, the column corresponding to the rkva. meter reading is brought in view and power factor read opposite the demand on the frame.

It would be difficult to estimate the specific time saving from the use of this device; it is substantial however. Moreover, the accuracy is perfect—an absolute necessity in billing.

•

Urges Smaller Motors for Farm Machinery

By C. P. WAGNER

Manager, Rural Service Dept., Northern States Power Co., Minneapolis, Minn.

The accompanying chart from the Farm Electric Service Handbook, which is being distributed as an educational service among rural customers of the Northern States Power Co., has been developed to demonstrate graphically the load-carrying characteristics of farm electric service.

There is a great temptation for farmers to purchase larger motors than are needed. Small motors (3, 5 or 7½ hp.) can operate most farm equipment. It is the object of the chart and its discussion to show that such general purpose motors possess enough overload capacity to handle variable type loads—such as ensilage-cutting machines—for which the average power over the duty cycle equals the motor rating, but for which momentary power demand may exceed motor rating.

On the chart the cross section at the bottom of the bars shows the no-load power required by feed grinders (constant type load) and silage cutters (variable load) operating at the correct speed for the motor capacity. The clear bar section shows the working capacity to full load. Crosshatched portions indicate overload capacity available for handling peaks of the load cycle. In such cases, however, it is cautioned that the maximum peak

Oh How They HAVE To Get Up In The Morning

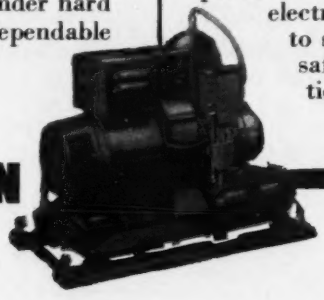
Bombers never sleep late. No sir! It's up at the crack of dawn . . . up for a crack at the enemy. And during the warming up period, when bombers get their "shave and shower," you hear the steady hum of the good old "putt-putts" . . . the Homelite Portable Generators that pour out juice for charging batteries and testing electrical equipment on those giant fighting birds.

And don't forget this . . . ground crews, the men who groom the planes, demand top-notch performance and reliability. Failures drive them nuts. And the specifications handed down for the equipment they use are a challenge to manufacturers.

Yet, here at Homelite, we're making gasoline-engine-driven generators that meet these needs . . . so light-weight, they can be carried in the plane . . . so compact, they can be moved anywhere at the base. Strong, durable generators that stand up under hard usage. Powerful ones, that generate plenty of current. Dependable Homelites, that operate in any climate.

Oh how they'll HAVE to get out at night

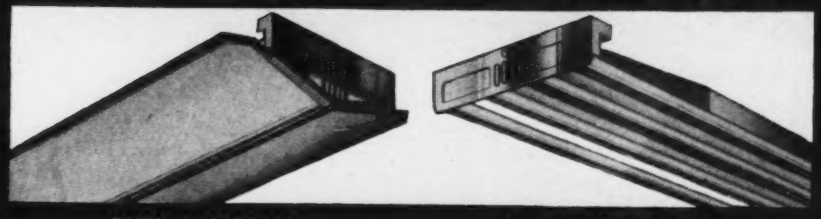
After the war, Homelites will be back on the old stand . . . making many new friends . . . by furnishing power for brilliant floodlights and electric tools, so necessary to speed work and increase safety on night construction and emergency repairs.



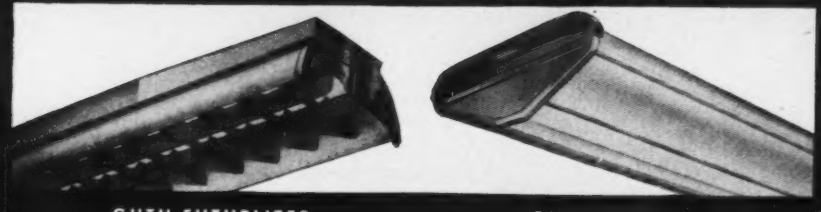
HOMELITE CORPORATION
PORT CHESTER, NEW YORK

In a nut-shell...

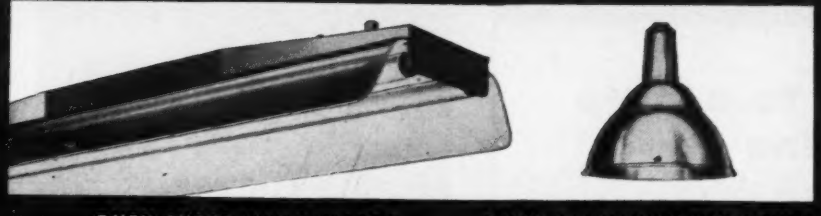
Guth *There's a* **FLUORESCENT FIXTURE** *for Every Modern Lighting Need!*



GUTH ARISTOLITE — GUTH LIGHTRONICS



GUTH FUTURLITER — GUTH EXCELUX



GUTH SUPER-ILLUMINATOR — GUTH ALUMINUM HIGH BAYS

GUTH Fluorescent Lighting is available in types for every requirement. Smartly styled—modern—efficient—dependable! That summarizes today's GUTH Fluorescent—the engineering achievement based on over 40 years of lighting leadership!

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GUTH Germicidal Lamp Units—the new, *proven* way to destroy air-carried bacteria—help control contagion. Complete engineering and layout data now available. Use coupon below.

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load of the cycle must not exceed 200 percent of motor rating; otherwise the motor will have its speed reduced and will pull out, causing operation of motor overload protection, regardless of average load.

Discussion accompanying the chart further points out, in comparing a motor with a gasoline engine, that the engine will not respond to overload except when energy is stored in a flywheel. The motor, however, will

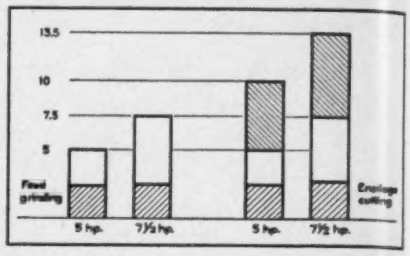


CHART SHOWS farm operators how 200 percent overload capacity available in electric motors permits relatively small units to be used on variable type farm loads (such as ensilage cutting) where duty cycle peaks may momentarily demand double the nameplate horsepower

respond instantly to overload within 200 percent of rated capacity. Work performance of one hp. of gasoline engine capacity is equivalent to one hp. electric motor capacity only on a constant load, such as feed grinding.

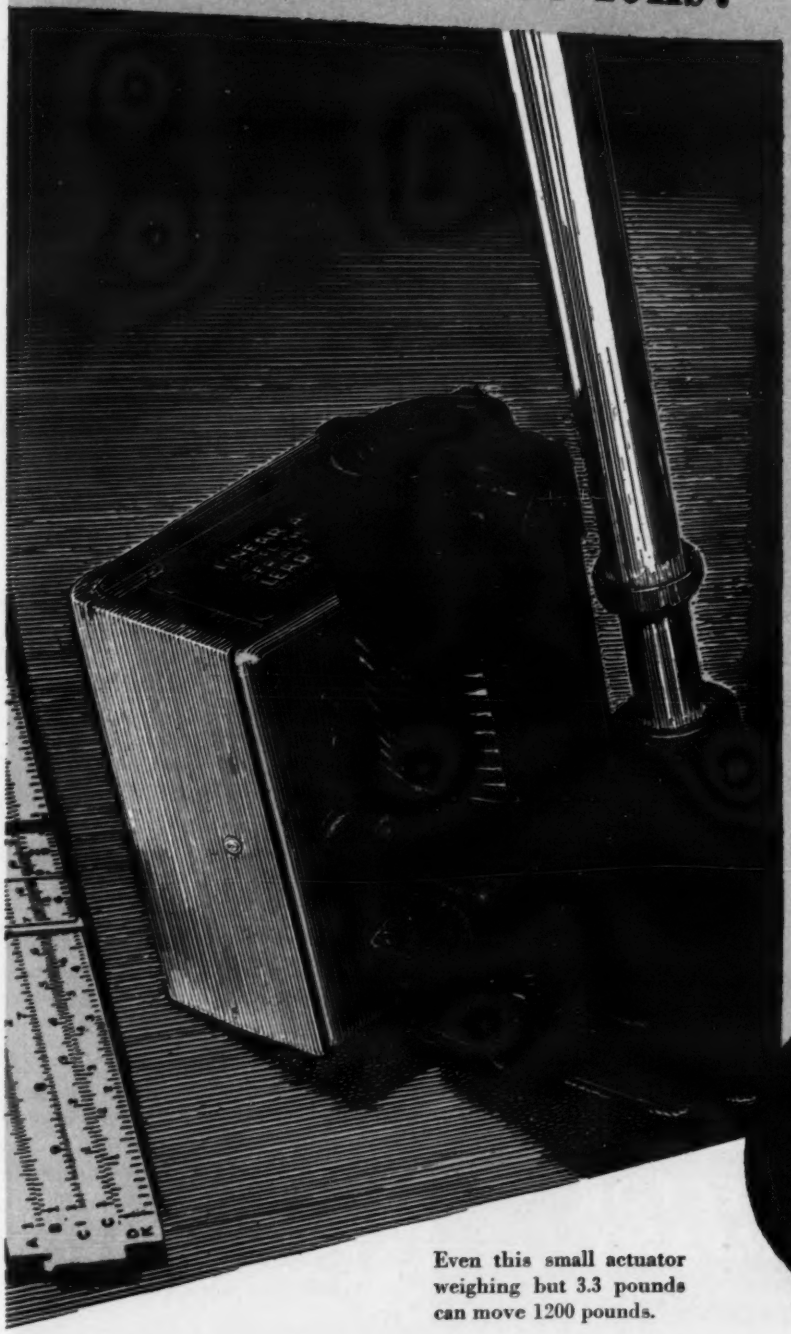
Variable Loads

For such variable farm loads as silo filling, a five-hp. motor can—because of its 200 percent overload capacity—do work that would require ten hp. of gasoline engine capacity. Similarly, a 7½ hp. motor could handle the same variable load duty that would require a 14-hp. gasoline. If a silage cutter was equipped with additional flywheel capacity, size of the required gasoline engine might be reduced. However the duty cycle peak of a silage cutter is usually of longer duration than can be handled by flywheels.

Wood saws have a peculiarly short load peak. Therefore there is considerable value in flywheel energy storage. Some tests show that a three-hp. motor with 200 percent overload capacity on a wood saw using a flywheel to provide additional follow-through can supply about twelve hp. to a cut. This flywheel type of operation makes it possible to do a good sawing job with a three-hp. motor.

The comparatively small amount of

Want to move 35 Tons?



Even this small actuator weighing but 3.3 pounds can move 1200 pounds.

WE wouldn't tell you how fast America's fighting planes go. That's a military secret.

But we've all read it's well over 300 miles an hour.

We've read too how they hit 700 or 800 miles an hour in dives. And how paint was peeled by the air pressure.

Did you ever stop to think that the plane's flaps and controls have to work surely, smoothly and dependably against pressures like that?

It's done by such mechanisms as you see in the picture.

They are called Lear Actuators.

They are powerful. Some can push up to 75,000 pounds.

They are light. That's a "must" in aircraft.

They are small. They have to fit in available space.

A good many preconceived notions had to go by the board to meet all these requirements. For example, the little electric motor that runs them is full of revolutionary engineering refinements.

Every man and every minute we have now can't make all the motors and actuators that we would like to deliver for Uncle Sam's aircraft.

But the day is coming when they will have different jobs to do. New jobs on peacetime products—perhaps like steering ocean liners, or parking cars, or things we've never thought of.

That is one reason for this advertisement. We want to know who can use an actuator or a motor like these.

Another reason is, we want you to know that there is available the kind of thinking and engineering which have produced these and some 250 other Lear products.

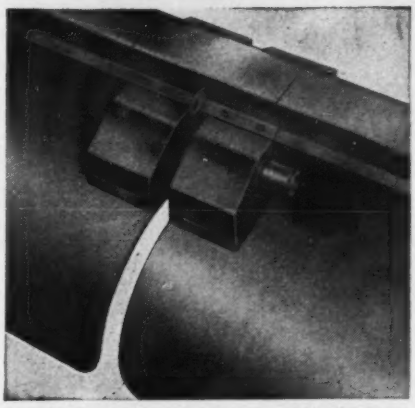
LEAR AVIA INC.
PIQUA · OHIO

Check The Details—
See why Wheeler means
"Skilled" Lighting!

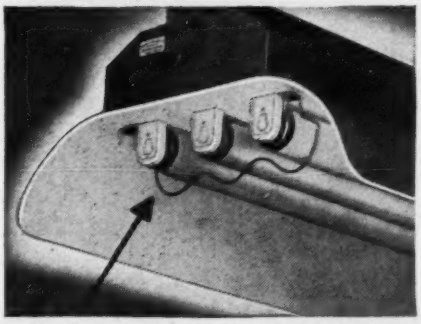
From end to end, Wheeler Reflectors are engineered with all the skill and experience of Wheeler's 62 years' specialization in lighting. They're "skilled lighting" that insures maximum lighting efficiency, durability, and convenience of installation and maintenance.

Examine a Wheeler Fluorescent Fixture, for example. Compare its high rigidity, obtained in spite of WPB metal-restriction, by Wheeler's I-beam wiring channel construction. Notice that wiring is *completely metal-enclosed*, yet instantly accessible. Also note the accessibility of starter switches; the speedy adaptability of the unit to continuous runs; and the ample provision of knock-outs for any type of mounting.

Whether you need fluorescent or incandescent fixtures, specify Wheeler and you'll get such "skilled lighting"! **Wheeler Reflector Co., 275 Congress St., Boston 10, Mass.** . . . New York City. Representatives in principal cities.



Simpler Wheeler coupling speedily adapts single units to continuous runs. Note I-beam wiring channel design and accessible starter switches.



Another Wheeler improvement! New Lamp Retaining Guard for modern fluorescent fixtures. Provides new safety . . . positively prevents falling lamps.

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Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

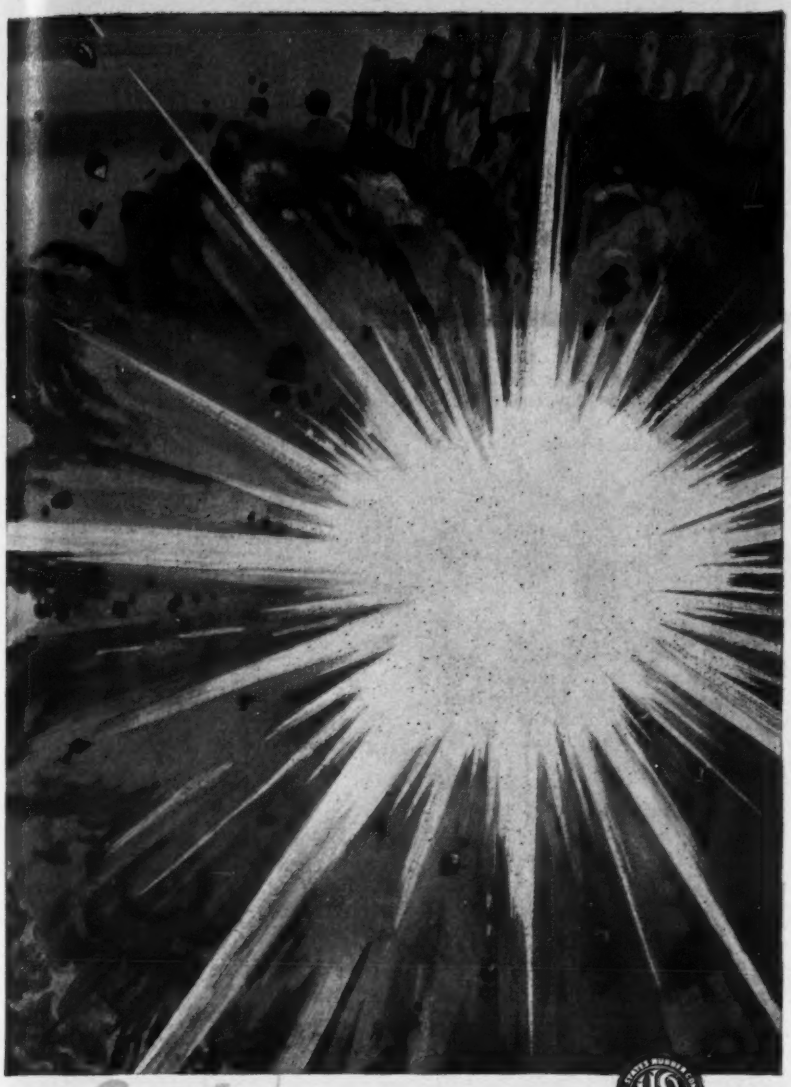
energy consumed in farm work requiring large motor sizes creates a serious problem for the utility, the chart discussion pointed out. Large motors require heavier lines, transformers and station capacity. While it might be said that the job will be done in less time with the larger motor, this is not necessarily true in all cases. Feed grinding can be made automatic, eliminating the time element and permitting use of small motors operating longer hours. Silo filling operates only to the capacity of the man on the wagon. In both cases the smaller motor—of say 7½ hp.—will serve to handle the operation.

Annual Service Plan Being Tried by REA

A method for annual payment of members' electric power bills is being tried by various co-operatives, according to Harry Slattery, administrator, Rural Electrification Administration, in his annual report.

Quoting from the report: "Some of the co-operatives are testing an annual service plan whereby members contract with the co-operative for a specific number of kilowatt-hours to be used during a one-year period. The members pay for a specified amount of electricity in advance, on the regular rate schedule, but receive an additional block of free kilowatt-hours in lieu of a discount for advance payment.

"REA is interested in ascertaining the practicability of the farmer paying for the electricity only once a year, eliminating monthly meter reading and many bookkeeping entries. Twelve borrowers in five states have initiated this plan on an experimental basis for a few members, ranging from 9 to 154. In each instance, a full year's operation indicates that the participating members prefer this type of billing, and with one exception the reports show that the plan has resulted in increased revenue to the co-operative. The experiment, therefore, will be expanded to include the entire system where the initial trial has been satisfactory; but recommendation to the REA co-operatives is contingent on further investigation."



WHEN A SHELL "WHUMPS" INTO THE EARTH...

...everything brittle for yards around may shatter.

That's why it's so important for the electrical insulation on wires and cables to retain its resiliency under all conditions of service. It does...on Laytex Wires and Cables... even when the weather changes from tropical heat to below zero within hours...also when subjected to continual vibration and repeated shock.

This enduring resilience of Laytex insulation is due to (1) The purified ingredients in the compound, (2) The unique process of building up a homogeneous insulation around the conductors by continuous dipping, drying, and vulcanizing. This combination results in perfect centering of conductors within an insulation so high in dielectric strength that the overall diameter can be appreciably reduced with safety.

Consequently Laytex Wires and Cables are lighter in weight, easier to handle, ship and store than those with conventional types of insulation...and they are also unaffected by long exposure to moisture.

Laytex **ASSAULT WIRE** U.S. **SERVING THROUGH SCIENCE**

SKI TROOPS USE Laytex Assault Wire for front line field telephones. On Detectors, Guns and Lights other types of Laytex Wire and Cable are used for power, signalling and control. Insulation of Laytex Wires and Cables withstands extremes of temperatures of all climates.

LAYTEX IS GLOBAL WIRE—All available facilities for producing U.S. Wires and Cables are still being devoted to the gigantic needs of the Armed Forces throughout the world.

We are repeatedly asked if we can furnish wire and cable for commercial and industrial uses. Not yet. But the time can't come too soon for us to resume peacetime manufacturing of Wires and Cables for Buildings, Police and Fire Alarms, Communications, Signalling, Power and Control.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE, ROCKEFELLER CENTER, NEW YORK 20, N. Y. • *In Canada:* DOMINION RUBBER CO., LTD.

NEW EQUIPMENT

Fluxmeter

Developed for measuring either flux density or the total magnetic flux in magnetic circuits, a new light-beam instrument has a

Fluxmeter: scale 50-0-250 millimeters; sensitivity obtained by interchangeable galvanometers. **General Electric Co.**, Schenectady, N. Y.

suspension type of element. By using search coils it can handle a variety of magnetic measurements. The control box contains a dry cell, resistors, rheostat, push button and a switch and provides a means of introducing a voltage into the electric circuit to compensate for small but undesirable spurious voltages that may otherwise cause errors.

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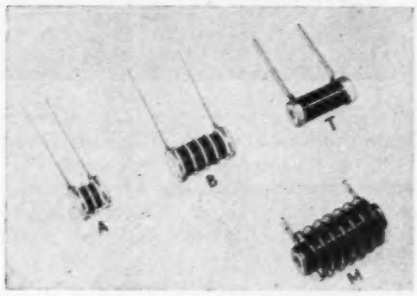
Resistors

Wire wound resistors with baked varnish finish have been developed for instrument and radio use. Depending on the type, ac-



Resistors: type "A" 15/32 in. long x 1/2-in. dia., 0.5 watt, 1 to 300,000 ohms, non-inductive pie wound; type "B" 15/16 in. long x 1/2 in. dia., 1 watt, 1 to 500,000 ohms, non-inductive pie wound; type "T" 1 1/32 in. long x 7/16 in. dia., 2 watts, 35 to 35,000 ohms, inductively wound; type "M" 1 13/32 in. long x 3/4 in. dia., 1.5 watts, 1 megohm, non-inductive wound. **Elco Resistors Co.**, 114 West 18th St., New York, N. Y.

curacy is said to be 0.5 to 1 percent, maximum operating voltage is 200 to 600, temperature rise in free air is 30 deg. C. and maximum operating temperature is 100 deg. C.

•

Capacitors

Type "EC" Capacitrons; capacities 3 and 4 mfd, 600 volts d.c.w., dimensions 1½ in. diameter, 4½ in. high. **Capacitrons, Inc.**, 318 W. Schiller St., Chicago 10, Ill.

Oil type capacitrons are designed to be locked on the chassis by a solid nut and lockwasher through a single hole to clear a ¾ in. x 16 threaded bakelite neck. The bakelite neck is lock-spun into the extruded insulated metal container, making possible a 100 percent hermetic seal, it is claimed.

•

Magnets

Type BR rectangular magnets: three sizes of magnetic cases, 42⅝ x 26¼ in., 62¼ x 26¼ in., and 80 x 29 in. **Electric Controller & Mfg. Co.**, 2700 East 79th St., Cleveland 4, Ohio.

Rectangular magnet construction has circular coils which is said to result not only in a stronger coil winding but also in a more efficient one. Ventilating openings are provided in top and both sides of the case to permit free circulation of air around each coil case. Coil terminals are protected by a waterproof terminal box.

•

Compactness Tester

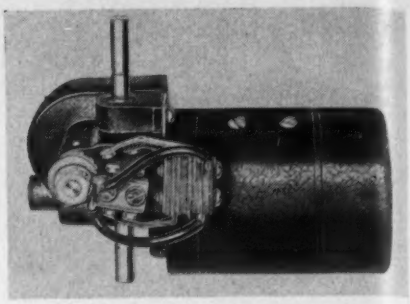
"No. 84400" compactness tester: measurements made by both penetration and torque methods. **Central Scientific Co.**, 1700 Irving Park Road, Chicago, Ill.

Tester has been developed to evaluate the compactness of the layer structure of laminated dielectric and the filler spaces of paper-insulated, high-voltage, underground, power transmission cable. Penetration test mechanism measures the depth to which a needle penetrates into the filler space under the impact of a 150-gram weight falling through 25 mm. Torsion mechanism measures the amount of torque required to turn a needle of rectangular cross-section, which is inserted between adjacent layers of insulation, through an angle of 30 deg.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data names and addresses.

Gear Unit

Newly developed gear unit obtains its quick stopping action by means of a brake which applies itself in either direction of rotation, or the reversibility of the motor



Model "B-1" gear unit: available for fractional horsepower motors. **Electric Motor Corp.**, 1204 State St., Racine, Wis.

to which it is applied. It is designed to stop a motor almost instantaneously and thereby prevent overrun usually experienced in braking electric power driven devices.

•

Service Receptacle

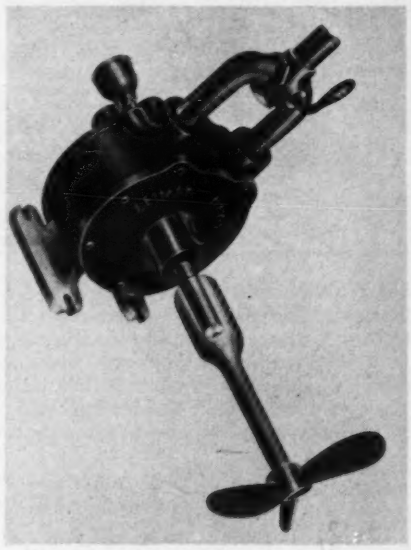
"No. 2127H" two-terminal midget twist-lock receptacle: rated 15 amp., 125 volts; 10 amp. 250 volts. **The Wiremold Company**, Hartford 10, Conn.

New receptacle has been designed for installation in No. 2100 Plugmold and extends the utility of this "plug-in-anywhere" convenience wiring system for industrial applications along work benches, inspection racks, and assembly lines.

•

Air Motor

Rotary airmotor has been designed for constant and variable speed drives. Close regulation of power and speed is obtained by operation of the air valve. The motors are reversible by the same means of air valve control. This type of motor can be adapted for some drives where explosive or flammable gases or material are present.



Compressed-air-operated airmotor: range of sizes, utilizing compressed air from 1 cfm up, pressure from 10 to 100 psi, horsepower range from 0.03 up, speeds 50 to 1800 rpm. **Leiman Bros.**, 113-28 Christie St., Newark, N. J.

A Case of Identity

REQUISITES FOR LIGHTNING ARRESTERS

1. High Protective Level
2. Ability to Carry Heavy Surge Current
3. Good for Both Long and Short Wave
4. No Breakdown on Normal Current
5. Moisture Proof *
6. Operate in All Climates
7. Long Life
8. Field and Laboratory Success
9. Ability to Prevent Line Lock-out
10. Operating Characteristics Unchanged Over Long Service

The men illustrated above are three Electrical Engineers and a Purchasing Agent. These men collaborated in preparing the list of "Requisites for Lightning Arresters" shown at the left. The list was recently published and distributed by a leading Electrical Trade Paper.

* No. 5 was unanimously voted most important.

OPERATING MEN ASK FOR IT!
HUBBARD AUTOGAPS HAVE IT!

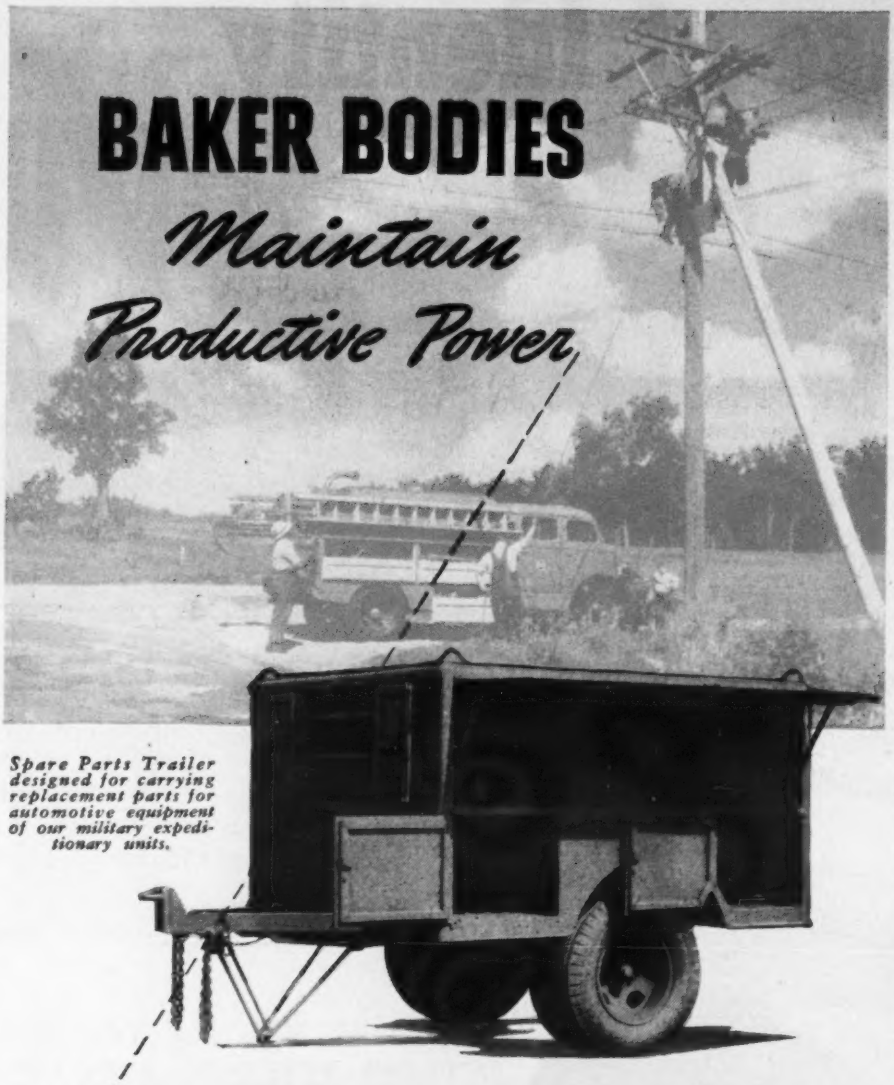
Hubbard Autogaps Have the Answers

1. Yes! Rapid operation — characteristics are fixed. Breakdown point 55% of insulation strength of equipment.
2. Excellent! In excess of 65,000 Amperes of surge current without failure.
3. Yes! Handles Long and Short Waves with equal ability.
4. No! Gap settings are above possible 60 cycle voltages.
5. Better than moisture proof. Design characteristics for Expulsion Type Arrester not affected by moisture.
6. Yes! High and low altitudes — high and low temperatures have not affected good performance.
7. Yes! Made entirely of time-tested, durable material — virtually unaffected by each operation.
8. Excellent laboratory performance confirmed by several years field experience.
9. Yes! Multiple gaps in series containing *no fusible material.*
10. Field experience proves unchanging values over long period of service. Oscillograms are available.

In other words . . . these four men might well have written a single word on their list . . . "Autogaps"

HUBBARD AND COMPANY

PITTSBURGH . . OAKLAND CALIFORNIA CHICAGO



BAKER BODIES
Maintain Productive Power,

Spare Parts Trailer designed for carrying replacement parts for automotive equipment of our military expeditionary units.

and Fighting Equipment on Every Front

Electric Power is the life-blood of manufacturing plants turning out implements of war. Baker Utility Bodies of pre-war years are helping maintain the power lines which serve these plants . . . Today our entire plant is producing war products, including truck bodies and trailers designed for maintaining essential fighting equipment.

Sturdy construction of Baker Bodies and excellent user care have kept many in service long after their normal replacement period. Because there will be a great demand for new equipment in the future, we recommend that you anticipate your requirements now and let us know your needs.

THE BAKER-RAULANG COMPANY
Utility Body Division
1284 WEST 80th STREET • • CLEVELAND, OHIO

Dependable AS THE SERVICE THEY HELP TO MAINTAIN

Baker BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

TECHNICAL LITERATURE

"USES FOR THREE-DIMENSION PICTORIAL DRAWINGS" outlines the advantages of such drawings in depicting shape and part relationship in one view, in planning manufacturing and assembly operations and in taking the place of models. These drawings also prove useful for determining clearances and possible interferences and for saving time in training new employees. The bulletin No. 4311 is available from I-T-E Circuit Breaker Co., 19th and Hamilton St., Philadelphia 30, Pa.

RECORD CONTROL SYSTEMS—Administrative problems are answered by descriptions and illustrations in a publication "Graphic-A-Matic Management Control" which presents methods for controlling production, material, procurement, personnel, sales and accounting systems used by 137 business organizations. A copy of the book can be obtained by any business executive who forwards a request on his company letterhead to Remington Rand, Inc., systems and methods research department, Buffalo 5, N. Y.

"RAPID-RELEASE LATCHES FOR CIRCUIT BREAKERS" is the title of a four-page presentation which discusses the design of dead-center and overcenter latches. The use of such latches is not confined to circuit breakers, and this publication should be valuable to designers of such equipment as automatic machinery and safety devices. Equilibrium diagrams are shown for both frictionless and frictional operation. Design limits are included for reducing strains caused by load and for eliminating the effects of impact in high-speed operation. This bulletin No. 4312 may be obtained from I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

QUENCH BATHS—A discussion of time-temperature transformation (TTT) curves as an aid in improving physical properties of steel products, cooling rates of various quenching media and design and construction of the bath, also several commercial applications of the TTT curve, are presented in a pamphlet "Isothermal Quench Baths Applied to Commercial Practice." Copies are obtainable from Ajax Electric Co., Inc., Frankford and Delaware Aves., Philadelphia, Pa.

VULCANIZED FIBER—An up-to-date compilation of adopted standards dealing with the manufacture and test of vulcanized fiber are contained in Publication No. 43-87, obtainable from the National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y.; price 25 cents per copy. The manual includes practical information on the following subjects—description and standard grades; standard colors of sheets, tubes and rods; dimensions of sheets, blocks, rods and tubes; standards for physical, electrical, and chemical properties.

"LIST OF INSPECTED FIRE PROTECTION EQUIPMENT AND MATERIALS" includes all listings up to Jan. 1, 1944, under headings from air-conditioning systems, through extinguishers, hose, pumping equipment, signal and watch service appliances, sprinkler and standpipe equipment, to window frames and accessories. This semi-annual revised list has been issued by Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago 11, Ill.; 161 Sixth Ave., New York 13, N. Y.; and 500 Sansome St., San Francisco 11, Calif.

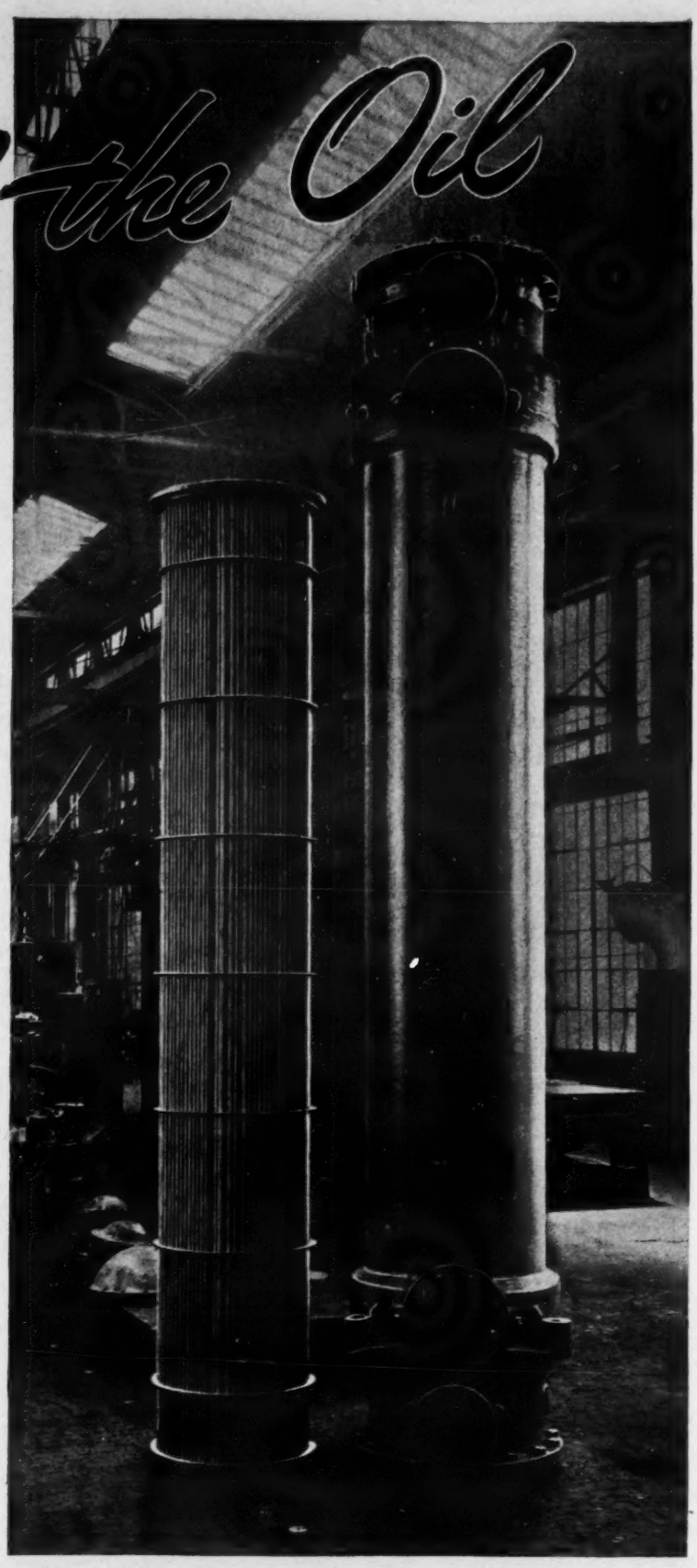
To Cool the Oil

FOR 3600 HP DIESEL ENGINES

Measuring more than fourteen feet overall, and 26 inches in diameter, this main lube oil cooler made by Schutte & Koerting Company, Philadelphia, is serving one of sixteen 3600 hp Diesel engines which furnish power for a large industrial plant.

The entire tube bundle, including tubes, tube sheets and baffles, is of Anaconda Muntz Metal to provide efficient heat transfer.

The wide variety of specialized copper alloys, the engineering experience and research facilities provided to so many manufacturers and users of heat transfer equipment is at your service. Publication B-2 lists Anaconda Condenser Tube Alloys, describes their manufacturing processes, compositions and fields of application. We'll be glad to send you a copy. 44105



Main Lubricating Oil Cooler for 3600 hp Diesel engine, built by Schutte & Koerting Company. Entire tube bundle is made of Anaconda Muntz Metal.

ANACONDA

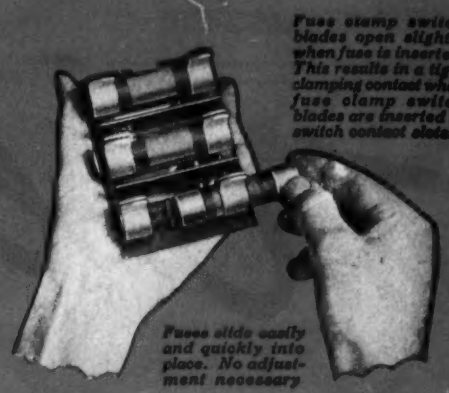
Anaconda Heat Exchanger Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

It's Easy

to slip in the fuses— but they're *clamped tight* for perfect contact . . .

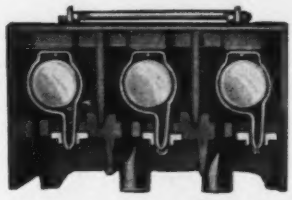


Fuse clamp switch blades open slightly when fuse is inserted. This results in a tight clamping contact when fuse clamp switch blades are inserted in switch contact slots.

Fuses slide easily and quickly into place. No adjustment necessary

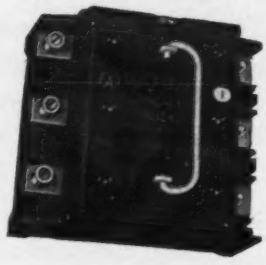
The FA PULFUZSWITCH

insures against loose contacts and resultant overheating . . . The fuse-holding switch blades are so designed that the placing of the fuse carrier into the ON position of the switch automatically *clamps the fuses tight* . . . At the same time, the switch blades make *pressure contact* with the fixed switch parts, insuring full current carrying capacity. . . . These photographs show how this is accomplished.



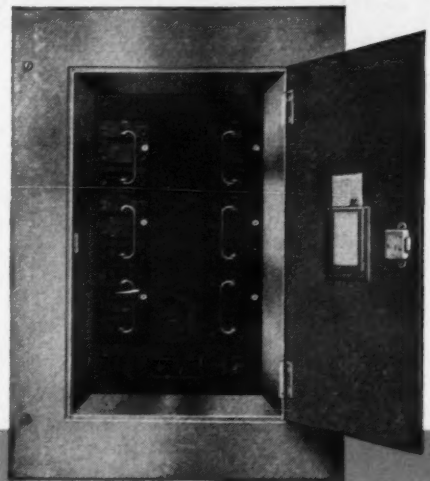
Note how fuse clamp switch blades, in ON position, make pressure contact with switch contact slots in the base. This draws the tips of the switch blades together, and pulls fuse clamps tightly around fuse ferrule. Contact parts are silver plated, for low resistance and long life. Bakelite barriers isolate each fuse in an individual compartment.

Each unit is equipped with FA solderless type pressure connectors; visible ON and OFF indicators; ventilating holes in fuse carrier; contacts for bus or cable integral with contact slot member, and pull handle for reversing switch.



FA PULFUZSWITCH units are made in 30, 60 and 100 ampere capacities, for 250 volts or less; also 30 and 60 ampere, 600 volts. They are assembled into panelboards (with either single or double row of branches) for all types of feeder systems. 60 ampere branches are convertible to 30 ampere—a desirable convenience for heat and power service.

Boxes are of galvanized steel. Wide gutters and FA Pressure type (Solderless) Connectors expedite wiring. Fronts are rust-proofed, and attractively finished in pearl gray. Available for both surface and flush mounting . . . For further information, write Frank Adam Electric Company, Box 357, St. Louis, Mo.



FA Pulfuzswitch Panelboard, double branch, with 60 amp. 3 pole branches.

EST. 1891 — THE SIGN OF A FA BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

NEWS ABOUT PEOPLE

Graybar Electric Elects Powell Vice-President

Charles S. Powell has been elected a vice-president and director of the Graybar Electric Co. Mr. Powell began

his career with Graybar (then Western Electric Co.) 30 years ago, immediately after attending Stanford University and Case School of Applied Science from which he was graduated in electrical engineering.

His experience with Graybar covers such consecutive assignments as student training course at Chicago, telephone specialist at Omaha, telephone, radio and appliance specialist at St. Louis, manager of Nashville (Tenn.) branch, manager of Louisville (Ky.) branch, telephone sales manager at New York, New England district manager at Boston and, returning to headquarters at New York in 1943 as manager of communications and merchandising departments.

Mr. Powell will continue to head all company sales activities in communications and merchandising lines.

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▶JOHN L. COLLINS, plant engineer in charge of distribution engineering and continuing property records, Central Maine Power Co., Augusta, has been elected vice-president of the Maine Association of Engineers. He entered the company's employ in 1924, being a graduate of the University of Maine. At one time he was superintendent at Boothbay Harbor, later being in charge of electrical construction and then operating superintendent at the Gulf Island hydro plant. Mr. Collins was then western division engineer and until 1937 superintendent of the Wyman hydroelectric station on the Kennebec River.

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Scholl to Direct Bright Light Reflector Sales

Announcement has been made of the appointment of Charles E. Scholl as general sales manager of the Bright Light Reflector Co., Inc. He will operate from the factory and executive offices in Brooklyn, N. Y., and from this point will direct sales for all branch offices. Mr. Scholl has been with Bright Light since 1935. For the

past five years he has acted as manager of the engineering division.

Mr. Scholl is a member of the board of managers of the Illuminating Engineering Society (New York section), a member of the Electrical and Gas Association of New York and is active on several committees of the National Electrical Manufacturers Association.

Allis-Chalmers Elects Three Vice-Presidents

Directors of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., have elected three new vice-presidents: William C. Johnson, who has been general sales manager; William A. Roberts,

W. C. Johnson

manager of the tractor division, and James M. White, who is now serving in the capacity of works manager.

Mr. Johnson joined the Allis-Chalmers organization in 1924 and after serving in the shop, in the foundry and on an erection job at the Riverside pumping station in Milwaukee, went to work on crushing machinery. He became an expert on new crushing equipment then in the process of development and was sent all over the country to service the equipment.

In 1929 he was made the representative of the crushing and cement division in the Atlanta, Ga., district, which included seven southeastern states. In 1935 he was transferred to Chattanooga, Tenn., in a general sales capacity, and two years later he opened up a company district office at Knoxville, Tenn., where he handled contracts with the Tennessee Valley Authority, the aluminum and phosphate industries. He also went out of the country several times to conduct important sales negotiations.

In 1940, Mr. Johnson returned to Milwaukee as sales manager for the crushing and cement division and two years later he was named manager of the Allis-Chalmers general sales organization.

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▶MALCOLM MORRISSON, for many years in charge of the municipal department of the Oklahoma Gas & Electric Co., has in addition been assigned the duties of

"Long Life" Processed
SELKIRK RANGE
High Altitude
WESTERN RED
CEDAR POLES

- FULL LENGTH MACHINE SHAVED
- FULL LENGTH TREATED AND STERILIZED

★ Clean, smooth, and dry . . . no projecting knots of bulging wood areas —full length machine shaved or planed, either for surface-smoothing only or for reduction of sapwood to thickness as may be desired by purchaser —all remaining sapwood impregnated with the toxic creosote preservative —full length heat sterilized—all natural checks completely protected by elimination of "air pockets" through heat application and thorough treatment of every check from pole surface to full depth—butt treated by BELL'S Fibre-Spreading method of incising—NO pounding, NO crushing, NO breaking of important wood fibres on the ground line area—manufactured from close-grained mountain timber widely known for its highly toxic heartwood and natural excess strength.

Write for a personal letter of details on our "Long-Life" Process Poles.

Greater Strength—because of growth density

Greater Shock Resistance—because of compact fibre structure

Longer Life Expectancy—because of thinner sapwood in proportion to total cubical volume of naturally toxic heartwood

Perfect Pole Requisites—because they possess extraordinary stability, are light in weight, have low conductivity, permit spans of greater length, carry heavier loads, have very even taper, are straight, and possess unusual elasticity.

BELL LUMBER & POLE CO.
MINNEAPOLIS, MINNESOTA

** Buy United States Government "attack" bonds today for the sake of your dollars tomorrow*

BELL 1944 LBR. & POLE CO.

BELL WESTERN RED Cedar NORTHERN WHITE

the late George McLean, with the title of assistant to the president. Mr. Morrisson has worked closely with Mr. McLean for the past several years, and is well qualified for his new responsibilities. His work for the past ten years, since joining Oklahoma Gas has been in connection with municipal sales and services and the renewal of franchises.

▶B. E. STOUTEMYER, Portland, Ore., district counsel for the Bureau of Reclamation in Idaho, Washington and Oregon, and one of the West's most eminent water-right lawyers, has resigned after 35 years of service. CHARLES E. CROWNOVER, construction engineer on the Rosa division of the bureau's Yakima project in Washington and director of that important work during the period when the most complicated features of the project were successfully completed, has also retired. Mr. Crownover completed 35 years of service on March 1. JOHN A. BEEMER, construction engineer in charge of the building of Anderson Ranch Dam of the Boise project in Idaho, has retired. He has been identified with the bureau since 1933.

▶E. H. LINDSAY has been appointed advertising manager of the St. Joseph Railway, Light, Heat & Power Co., St. Joseph, Mo. For some time, Mr. Lindsay has engaged in advertising work for the St. Joseph utility.

▶BRUNO R. NEUMANN, until recently senior economist with the planning division of the War Production Board, has joined the National Foremen's Institute, Inc., Deep River, Conn., as labor economist and editorial director. He will make his headquarters at the company's editorial office in New York. Mr. Neumann will head the Institute's research and consulting service on labor economics and labor relations. Prior to his connection with the War Production Board, Mr. Neumann was a member of the economic research staff of the National Association of Manufacturers. His experience abroad includes intimate familiarity with economic and labor relations problems in Great Britain and other European countries as well as the United States.

▶F. R. MERRIS of Tacoma, Wash., has been appointed general manager of the Washington Gas & Electric Co. Since 1930 he served as secretary-treasurer of the utility and was previously associated with the Ohio Electric Power Co. in Sidney and Columbus, Ohio.

▶FORD W. HARRIS has been appointed engineer of the Union Water Power Co., Lewiston, Me., succeeding the late Paul L. Bean. Mr. Harris was graduated from Rensselaer Polytechnic Institute,

entering Central Maine Power Co.'s employ in 1924 during the construction of the Gulf Island hydro plant, and has been with that organization since except for a brief interim. Lately he has been a member of the engineering department of Nepsco Services, Inc., Augusta, Me., with which the Maine utility has affiliations.

▶ A. JAY HALL, power engineer, commercial department, general office, Southern California Edison Co., has retired after more than 28 years of service. Mr. Hall's work has been in the field of water systems and irrigation pumping. He now plans to start a consulting engineering firm specializing in tests on water pumping plants and offering advisory service on water systems.

▶ A. J. TIGGES has been appointed manager of consulting engineering for all divisions and subsidiaries of the Baldwin Locomotive Works, Philadelphia, including locomotive and ordnance, Southwark; standard and foundries divisions, Pelton Water Wheel Co., and the Whitcomb Locomotive Co. Besides his duties as general consultant, Mr. Tigges will have charge of the engineering of new products and new applications with reference to post-war plans. Since his graduation from Massachusetts Institute of Technology in 1923, Mr. Tigges has been associated with the engineering firm of Jackson & Moreland, Boston, doing general engineering research and development work. He also represented that firm as managing engineer for a number of large power plants.

▶ W. T. DARCY has been appointed manager of service shop sales at General Electric Co., Schenectady, N. Y. Mr. Darcy will supervise and co-ordinate the repair and renewal parts business-building activities of G.E. service shops all over the country. He retains his duties as manager of renewal parts division, industrial divisions, in addition to his new position.

▶ K. F. BOLDT has been appointed advertising and sales promotion manager of the American Phenolic Corp., Chicago. Mr. Boldt has had a background of more than 20 years in advertising and sales promotion work. His headquarters will be in the main offices of the company in Chicago and his responsibilities will include the supervision of market analysis, promotional sales planning and scheduling of advertising.

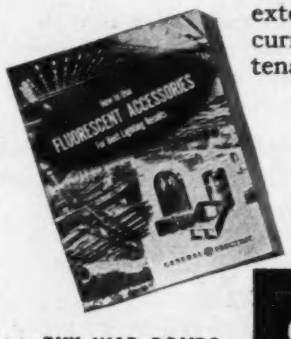
▶ WARD E. KRONE has been appointed assistant superintendent of the industrial heating manufacturing division at General Electric's Pittsfield (Mass.) Works. Since 1940 he has been act-

Outlasts five ordinary starters

G-E Watch Dog Fluorescent Starters have gained nation-wide popularity with fixture manufacturers, lighting engineers and maintenance men because Watch Dogs substantially reduce maintenance costs. It isn't necessary to replace a starter each time a burned-out lamp is changed. Under specified test conditions the FS-40 outlasts an average of ten 40-watt fluorescent lamps, FS-100 . . . eight 100-watt lamps. This exceeds the approximate life of five ordinary starters.

Reason For The Watch Dog's Long Life

When a dying lamp reaches the end of its normal life, blinking and flickering start but the Watch Dog cuts itself out of the circuit. Since there is no flow of current, burned-out lamps are prevented from being started needlessly and the life of the starter is greatly extended. In addition, ballasts are protected and current is conserved. All this results in lower maintenance costs.



SEND FOR NEW CATALOG

Our new catalog tells how to use G-E Fluorescent Accessories for best lighting results. You can obtain your free copy by writing to Section G342-16, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

BUY WAR BONDS

GENERAL ELECTRIC

FOLLOW THE ARROWS

TO THE *New* FAST, LOW-COST WAY TO MAKE SWITCH BOX COVERS

SIL-FOS and EASY-FLO
offer the lowest flow points and the fastest brazing action of all alloys that make high strength joints. Sil-Fos for non-ferrous metals. Easy-Flo for ferrous, non-ferrous alloys and dissimilar metals.

USE THEM ON
Structural Joints
Taps and Leads
Rotors and Coils
Electrical Terminals
Bus Bars and Switchboards
Electrical Contacts
Meters and Instruments
Repairs

FULL DETAILS IN BULLETIN 12-A

IT'S *EASY-FLO* BRAZED CONSTRUCTION

The brazing together of stampings and simple components with the low temperature silver alloy Easy-Flo, into units *equivalent to a single piece in all essential properties*, including water-tightness—that is modern Easy-Flo brazed construction.

It is well illustrated by the switch box cover above, on which extra high production is obtained by preplacing Easy-Flo wire rings and strips at the joints and brazing all 7 (two underneath) at one time with induction heating.

Already many types of electrical boxes and enclosures, and a wide variety of other products, formerly cast, forged, riveted or screwed together, have been redesigned for Easy-Flo brazed construction—and many more are now being designed for it from scratch. Why? Because—

Easy-Flo brazed construction means high strength, fast production, substantial metal savings and weight reduction, elimination of machining operations, lower costs.

You can depend on it, Easy-Flo brazed construction is here to stay. You can't afford to overlook it—get the facts by writing today for BULLETIN 12-A.

4th "E" Award
February 1944

HANDY & HARMAN
82 FULTON ST., NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

ing superintendent of the induction voltage regulator manufacturing division and a manufacturing assistant on the staff of the general superintendent. Mr. Krone was formerly located at the company's Schenectady and Erie Works.

▶SEYMOUR MINTZ has been appointed director of advertising and publicity for Admiral Corp., Chicago. He succeeds WALLY AEVERMAN who became sales promotion manager of Electric Household Utilities Corp. Previous to that he was sales supervisor of radios and major appliances for Montgomery Ward retail stores.

▶GEORGE H. MEILINGER has been appointed manager of the household refrigeration department of the Westinghouse Electric appliance division, Mansfield, Ohio. Mr. Meilinger will direct post-war development, manufacture and sale of home refrigeration equipment, including models equipped with food-freezing compartments. Identified with Westinghouse refrigeration engineering and sales development for five years, Mr. Meilinger will add the new assignment to his current job of supervising contract negotiations for the production of stabilizers and fuel tanks for bombers. He succeeds T. J. Newcomb, who was made division sales manager in 1942. Mr. Meilinger joined Westinghouse in 1938 as western regional supervisor of the refrigeration department, and in 1940 was promoted to sales development manager. He studied electrical engineering at Armour Institute of Technology, now known as the Illinois Institute of Technology. Before joining Westinghouse, Mr. Meilinger was associated with the General Electric Co.

▶H. J. WINES, for 17 years general sales manager of the Frigidaire division of General Motors Corp., New York and Chicago branches, has been appointed general manager and director of the newly formed Zenith Radionics Corp. of New York, subsidiary of Zenith Radio Corp.

▶J. J. DONOVAN has been named regional manager of the Chrysler Airtemp New York office. Mr. Donovan will direct Airtemp sales and service activities in the greater New York area and New England. Since 1941 Mr. Donovan has been associated with the War Production Board, Washington, D. C., as assistant director of the automotive division where he had direct responsibility for the production of automotive replacement parts, internal combustion engines, sleeve bearings and electric storage batteries including industrial and submarine types. Prior to his work with WPB, Mr. Donovan

had wide experience in the refrigeration and air conditioning industry.

OBITUARY

▶GEORGE W. MACLAUGHAN, general purchasing agent of Thomas A. Edison, Inc., West Orange, N. J., died on March 20 at Orange Memorial Hospital. He was 59 years old. Mr. MacLaughan had been with the Edison company for 27 years.

▶HARRY S. FISHER, who was prominently identified with the design and operation of the Southern California Edison Co.'s transmission system, died on Feb. 21 at his home in Santa Barbara. He had retired last December after almost 30 years of continuous service with the utility company. Born in Santa Barbara, Mr. Fisher entered electrical work in 1902 in the Kern River area. He was associated with Stone & Webster Engineering Corp. on the construction of the Big Creek transmission lines. He joined Edison in 1914 and had worked at Kern River until 1919, when he became a part of the engineering department, and later the operating department. He was made senior transmission engineer in 1931, the position he held at the time of his retirement.

WILLIAM R. HAMILTON, vice-president and general manager of the Dominion Electric Protection Co., Montreal, Que., died on March 1 at his home in that city after a lengthy illness. He was 63 years of age. He had been associated with that organization for 47 years. A native of Glasgow, Scotland, Mr. Hamilton took up residence in Montreal 57 years ago. He became identified with the Dominion Electric Protection Co. in the capacity of chief engineer.

▶ALBERT H. MILLS, of Chipman, N. B., for the past 15 years turbine engineer for the New Brunswick Electric Power Commission, at Chipman, died recently after an illness of six months.

▶JOSEPH F. LAMB, vice-president and member of the board of directors of Landers, Frary & Clark, died on March 6 at the New Britain General Hospital after a long illness. He was 69 years of age. Mr. Lamb became associated with Landers, Frary & Clark in 1904 as superintendent of the hardware works. He was named general superintendent of the entire Landers plant in 1906. In 1912, Mr. Lamb was elected a vice-president of the company and in 1918 he was appointed to the board of directors.

▶JOHN B. SMITH, production superintendent of the Southern Indiana Gas & Electric Co., at Evansville, died re-

COPPER TO COPPER PREVENTS METALLIC FIGHTS

Forged Copper

8-NU 6-NU 4-NU X2-NU 2-NU 0-NU

Matthews

Nutype Conductor Connectors

FOR COPPER TO COPPER CONNECTIONS

Pure Copper, Cold forged bolt of ample strength for all purposes. High copper content prevents corrosion and season cracking. All edges are rounded. 65,000 pounds tensile value.

"V" groove, clamping jaw of cold forged, pure copper. Flanged sides give greater bearing surface on nut, hence greater strength and no distortion of clamping jaw.

97% copper content, hard metal nut—strong as steel. Full thread engagement with bolt.

Broad, strong head, with size plainly marked. Sides of head have flat surface so wrench or pliers can grip tightly.

85% plus, full thread, die stamped, insures full engagement in nut, hence high strength connectors.

"V" shaped groove, holds wires in three point contact and prevents rocking or looseness.

Made in 12 sizes—6 of forged copper and 6 of machined high strength, high copper content alloy —for No. 10 to 1,000,000 CM conductors.

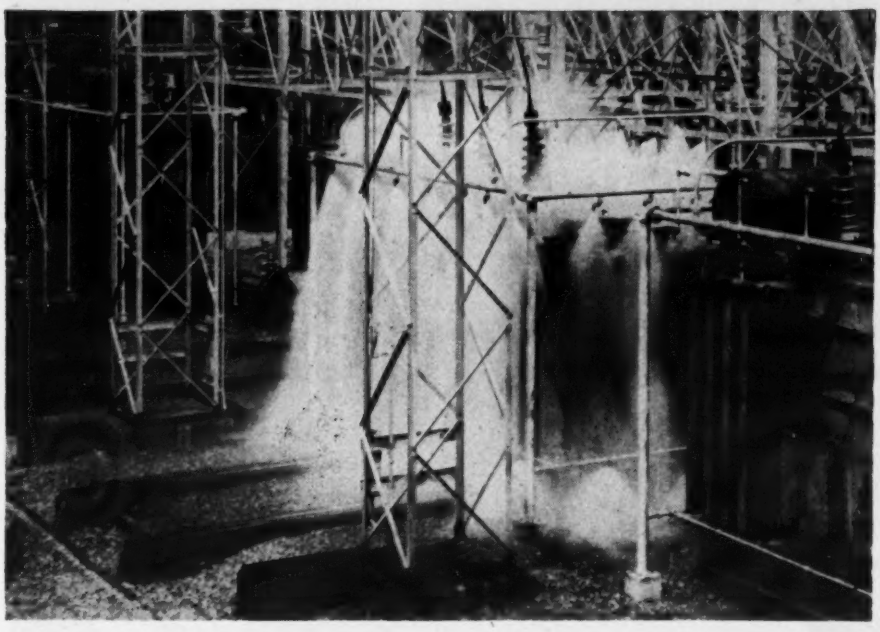
Send for bulletin and free samples and convince yourself of their superiority.

66-NU
44-NU
With Nut

X22-NU
22-NU
Retainers

W. N. MATTHEWS CORPORATION

ST. LOUIS, U. S. A.



FIRE PROTECTION...IN TIME

FIRE in a single transformer threatens the entire installation with leaping flames and explosions. To avert a major disaster, the protective system must go into action *fast* – must extinguish the fire immediately. That's why so many utilities protect oil-filled equipment with a . . .

GRINNELL MULSIFYRE SYSTEM

MULSIFYRE SYSTEMS operate on the principle of emulsifying blazing oil with a driving spray of water.

The oil is turned into a liquid which is incapable of burning. Fire is extinguished in a few seconds and reignition is prevented.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mysifyre Systems are permanently installed . . . they operate automatically or manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard . . . in transformers and other oil-filled electrical equipment.

INVESTIGATE this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories.

Grinnell Company, Inc.,
Providence 1, Rhode Island.
Branch offices in principal cities.

GRINNELL
MULSIFYRE SYSTEMS

cently in his fifty-first year. He was a native of Scotland. After service in World War I with a Scotch unit, he spent two years in Chile, then returned to Scotland. In 1923 he was sent to Mexico City as a representative of the Hanley Cable Co. of London. In 1924 he went to Peoria, Ill., as an associate of the Central Illinois Light Co. and in 1928 he went to Evansville and became associated with the Southern Indiana Gas & Electric Co.

▶ CHESTER ROLAND, superintendent of the Owen County (Ky.) Rural Electric Association, died February 13 in Owenton, Ky., in his thirty-fifth year.

▶ RALPH J. RITCHIE, senior production executive at the Camp Evans (N. J.) Signal Corps laboratory, died on March 19 at his home in Asbury Park, N. J., at the age of 60. Mr. Ritchie was well known in the utility field, having directed the consolidation of the various properties which compose the southern group of the Jersey Central Power & Light Co. Prior to his association with Jersey Central Power & Light, he was an engineer for the Insull utility companies in the Middle West.

▶ CLAYTON CARPENTER, 38, a service engineer on the staff of the Thomson-Gibb Electric Welding Co., Lynn, Mass., died at Palmer, Mass., in an automobile accident on Feb. 17.

▶ MILLER R. HUTCHISON, inventor of many electrical and mechanical devices, the best known of which are the Acousticon for the deaf, the dictograph and the Klaxon horn, died on Feb. 16 at the New York Athletic Club, of which he was a resident. His age was 67. He started his career as chief electrical engineer of the United States Light House Establishment, Seventh and Eighth Districts, and during the Spanish-American War was engaged in laying submarine mines and cables in the Gulf of Mexico. After he war he established his own laboratory in New York, where he worked on the practical application of electricity. In 1910 he became associated with Thomas A. Edison in special work on storage batteries. Three years later he was appointed chief engineer of the Edison Laboratory and affiliated Edison interests. He also served as advertising manager for the Edison Storage Battery Co. In 1917 he formed a company bearing his name, to act as sole distributor of Edison batteries, but after the first World War he resold the rights to the Edison company to devote his entire time to Government service. Mr. Hutchison held membership in the American Institute of Electrical Engineers, American Society of Mechanical Engineers and American Association for the Advancement of Science.

A WASTEFUL BROADSIDE *from your company*

CAN CRIMP A NAVY BROADSIDE

Against the Japs

YOU BET IT CAN. For the ammunition which our fleet fires reaches its destination protected by paper. And the paper you waste in an ornate, unnecessarily large advertising broadside is just what the Navy and the Army need to do their job.

That's why Uncle Sam asks you to watch every company project in terms of USING LESS PAPER. Whether it's a direct mail piece or a letter or a paper-board container—think of it as a challenge to you and to your colleagues. Yes, a challenge to you to see how you can carry on your business and at the same time cut down and cut down and cut down on your company's use of paper.

Remember the whole country is being enlisted in this drive. You'll be a soldier in a mighty army of paper conservers.

And remember, right now, there's no home-front conservation job any more urgent or important than the conservation of paper and paper board.

If your company or your community has not yet organized Paper Conservation Committees, why not start them yourself and now?

Use Less Paper Because

Each 500-pound bomb takes 12 pounds of paper for rings, tops and bottoms.

A fiber container for a 75-millimeter shell takes 1.8 pounds of paper board.

Each weapon part must be wrapped in grease-proof paper and in waterproof paper. A single shipping case of decontaminating apparatus requires 273 square feet of waterproof lining paper.

All kinds of paper are used by the Army, from vegetable parchment, .0015 inches thick, to heavy paper board and wallboard.

Use Less Paper These Ways

Use smaller type sizes and margins. (Any competent printer, in consultation, can point the way to pronounced savings by these means.)

Reduce separators to shoulder height.

Eliminate top and/or bottom pads in every practical instance.

Make scratch pads from stocks of obsolete letterheads, memorandum forms, and other unused inventory.

Cut the weight of paper stocks. (You tell the printer how long you expect a record to endure and he can tell you what stock to order.)

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER

Space for this advertisement contributed by ELECTRICAL WORLD

••• DIRECTORY •••
POWER LINE EQUIPMENT

TAKE THE GUESSWORK OUT OF FUSE LINKS

The right fuse—in the right place—at the right time—when you use Kearney handy Fuse-Paks-on the pole in a Fuse Pak Pole Dispenser No. 12165.

SERVICE INTERRUPTIONS STOP WAR WORK

Nearly 95% of all maintenance work can be done safely, quickly and economically with Kearney Hi-Line Tools while lines are working.

HOLDING POWER FOR HEAVY CORNERS

The No. 8120 Kearney 2-Way Expansion Anchor provides 10,500 pounds holding power in ordinary soil. Other Kearney Anchors provide relative holding power.

RELIEVES LINEMAN STRAIN

Kearney Heavy Duty Platform, No. 4901-36, provides a safe place and a normal working position for men on pole or tower.

KEARNEY SOLDERLESS WIRE CON-NEC-TITES

Made with the same precision and refinements yesterday, today and tomorrow. It will pay you to make comparisons.

TRIPOMATICS SERVING IN RUSSIA AND INDIA

Kearney Tripomatic primary fuse cutouts have gone to war along the far-flung battle fronts of the world. You'll never know what positive distribution line protection means until you try them.

THREE-FOLD PROTECTION

Kearney Trip-Saver (Reclosing) Fuse Switches saves trips and reduces outages as much as 90%.

EACH of the products described in this directory was scientifically developed and carefully fitted to the needs of the electrical industry. Space doesn't allow more than a few words about these products, but complete Bulletins are available on each and it will pay you to have complete knowledge of their use and application.

WRITE DEPT. H

JAMES R. KEARNEY CORPORATION

4224 Clayton Ave. St. Louis, Missouri

⚡ WHAMI ⚡

Are you sure when lightning strikes your lines that your fuse switches will dissipate the stroke and cut off the power follow-up in time to save line equipment. Better try Kearney Trip-Out Fuse Switches.

WARTIME POWER LOADS

Easily carried by the heavy blades and contacts of Kearney Hook Operated Disconnect Switches.

B-24 AND B-17

Precision equipment made by Kearney flies the skies over Europe and the Pacific Southwest with many a B-24 and B-17 Bomber. Experience in this field has broadened the scope of our manufacture to the benefit of our regular products.

DID YOU KNOW?

Did you know that on Regulator installations only three (3) Kearney Regulator By-Pass Switches are needed instead of nine (9) conventional disconnects? Ask about this.

HEAVY GANG SWITCHES

The heavy rugged design of Kearney Gang Switches have proved their worth in these days of overloaded lines.

SUBSTATION INSURANCE

Use sturdy Kearney Bus Supports and Power Connectors to handle today's heavier loads. Write for Bulletin No. 316.

BETTER BE SAFE THAN SORRY

If you must interrupt service protect your linemen with Kearney ground sets installed on both sides of place where work is done.

MINIMUM MAINTENANCE

—because operating coils are replaceable in the Kearney-Martin multiple relay. A new product for multiple street lighting circuits.

IMPORTANT LIGHTNING FACTS

Lightning is diverted off the line and to ground harmlessly when Kearney Lightning Arresters are used.

ACCESSORIES — PLUS

Take advantage of the many Kearney Pole Line Accessories that make the difference between an ordinary job and an excellent one. Use Kearney Guy Wire Clips, Dead-End Clamps, Ground Wire Clips, Ground Rod Clamps and other accessories.

WARTIME CONVERSION

Don't scrap old switch mountings—you can modernize them with Kearney Trip-O-Link or Tripout Conversion assemblies.

USE TRIP-O-LINK FUSE SWITCHES

For conservation of critical materials—particularly on rural lines—choose the revolutionary Kearney Trip-O-Link Fuse Switch.

SAVE METERS

Nothing is more scarce today than instruments. You can make most load and voltage surveys with one voltmeter and one ammeter when you use the new Kearney Recorder Selector Swtich.

COORDINATION —

is important in every industry, and fuse link coordination will save you many needless trips and outages. Write for Time Current curves on Kearney Fuse Links.

Use FOR BETTER MAINTENANCE and CONSTRUCTION— KEARNEY PRODUCTS

MANUFACTURING-MARKETS

Porcelain Insulator Standard Approved

A new standard for porcelain radio insulators, recently approved by the American Standards Association, is now available to industry and the Armed Forces. This standard completes a series of American War Standards, covering the broad field of ceramic insulation for communication and electronic purposes.

The standard on porcelain insulators extends the work on ceramic insulators. It follows the pattern of the preceding specifications covering insulators made of steatite, glass-bonded mica, and glass. Definite requirements for dimensional tolerances and finishes have been included in this standard as in the earlier ones. Included also is an appendix on design criteria recommended by leading manufacturers in each field.

Approval of this standard brings to a conclusion the work of this committee on insulation material specifications for the military services which has been functioning under the chairmanship of Dr. Alfred N. Goldsmith, representing the Institute of Radio Engineers.

A.S.A. has recently completed a standard for fixed ceramic-dielectric capacitors of temperature compensating types. This is another in the series of standards for military radio being developed by the A.S.A. at the request of the War Production Board.

•

Manufacturers Make Sales Assignments

Appointments to their sales staffs have recently been announced by the following manufacturers:

Pennsylvania Transformer Co. has appointed J. J. Costello Co. as sales representative in New England territory with offices in Boston, Mass., and New Haven Conn. The company has also appointed J. F. Joyce as district sales representative with offices in Cleveland, Ohio.

U. S. Rubber Co. has appointed W. S. Long Pacific Coast sales manager, mechanical goods. Mr. Long was formerly operations manager of the company's Los Angeles plant. He will continue in charge of war products activities on the Pacific Coast.

Col. C. E. Chatfield, who has been serving as operations officer of the Central Defense Command, Memphis, Tenn., was relieved from active duty in the Army upon abolishment of that command. He has returned to his former occupation as manufacturer's agent, covering the State of Indiana. He represents Burndy Engineering Co., Inc., Delta-Star Electric Co., Esterline-Angus Co. and Standard Transformer Co.

•

Additional Plants Get Army-Navy "E" Award

Announcement has been made of the award of the Army-Navy "E" to various manufacturing plants. They include: Bristol Co., first star; Bryant Electric Co., wiring device division and the plastic division; Philco Corp.; storage battery division, fourth award; Admiral Corp.; Cochrane Corp.; Copperweld Steel Co., second award; Handy & Harman, fourth award; Columbia Electric & Manufacturing Co.; Carlton Lamp Corp.; McGraw Electric Co., Toastmaster products division, renewal; Sylvania Electric Products, Loring Avenue and Boston Street plants, in Salem, Mass., and the Danvers, Mass., plant; P. R. Mallory & Co., fourth renewal.

•

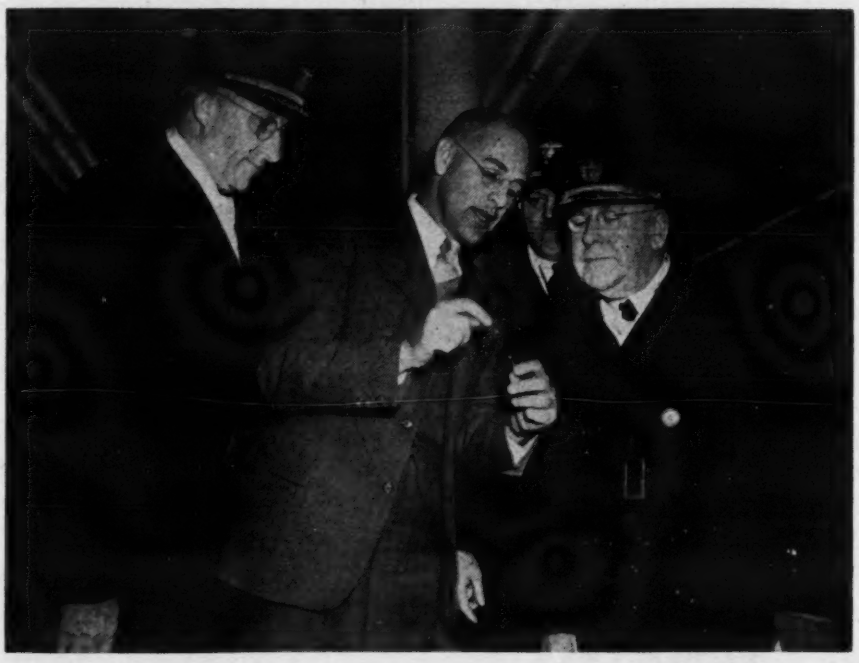
Blaw-Knox Reports Increase in Net

Blaw-Knox Company reports net profit for 1943 increased to $1,936,798, or $1.45 a share, from $1,425,718, or $1.07 a share, earned in 1942, despite larger tax charges. Provision for income and excess profits taxes for 1943 totaled $8,822,000, against $7,039,085 the year before. Total taxes paid or provided for in the year, the report stated, were $10,166,542, compared with $8,208,690 in the previous year.

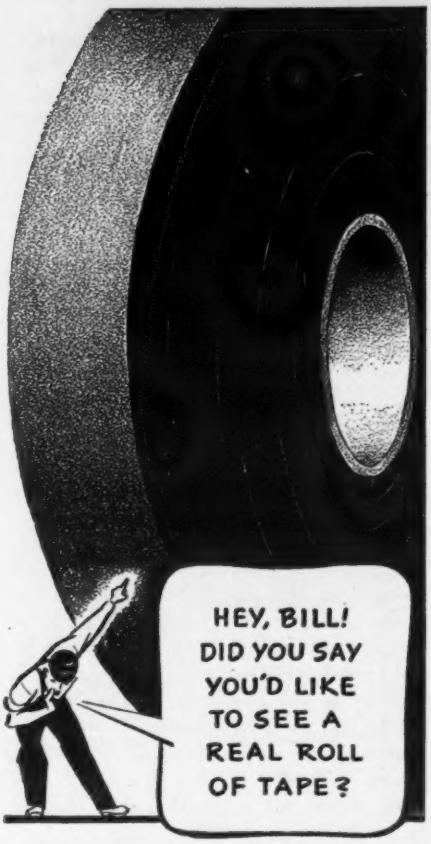
Billings for 1943, after provision of $3,000,000 for renegotiation of war contracts, aggregated $113,295,659 compared with $63,124,804 for 1942 and $30,799,560 for 1941, the first year of full wartime production.

In commenting on the company's post-war plans, William P. Witherow, president, said:

"The necessity of providing jobs for the boys returning from war is fully recognized, and in this connection the



INSPECTION TOUR—Navy officers show keen interest in the making of high-powered rough service incandescent lamps which are sturdy enough to withstand the terrific concussion of a battleship's salvo. Scene is Sylvania Electric Products' Boston Street plant in Salem, Mass., on the occasion of Army-Navy "E" Awards to this and two other Sylvania plants. R. E. Barrett, plant manager, explains rugged construction of lamps to Capt. John J. Hyland, inspector of naval materials, First Naval District, while other Navy officers look on



YOU'LL SPOT THE DIFFERENCE

If you have any doubts about there being much difference in tape, just try Jenkins Gold Seal Tape on your next tough job. You'll find that Gold Seal sticks tighter, insulates better with one thickness and stands up longer . . . that it doesn't "peel", ravel or dry out like "run-of-the-mine" tape! Wrapped in cellophane and box-packed to *stay* fresh! Made by the makers of Jenkins Diamond Seal Friction and Rubber Tape, which meet ASTM and Federal specifications . . . Jenkins Bros., Rubber Div., 80 White St., New York 13.

JENKINS

Gold Seal Tape

FRICTION ... RUBBER

management believes that the production of goods is the only real method by which employment can be obtained. While the efforts of the company have been and will continue to be dedicated to the output of products for winning the war, post-war planning has been given proper attention, and the company is investigating possibilities of new products and of extended use of its present products.

•

Corporate Name Changed by Commercial Control

Commercial Control & Device, Inc., Brooklyn, N. Y., has announced a change in its corporate name to General Switch Corp. Officers, personnel, products and services remain unchanged. The new name is considered more descriptive of the operations of the company.

The present officers of the company have been identified with the corporation for many years. They are: M. S. Muller, president; A. G. Muller, vice-president; W. H. Ross, secretary and treasurer.

•

Ordnance Plant Occupied by U. S. Rubber Co.

Announcement of the occupancy of plant No. 1 of the original Lowell Ordnance Works at Lowell, Mass., by the wire and cable department, United States Rubber Co., has been made by C. W. Higbee, manager of that department.

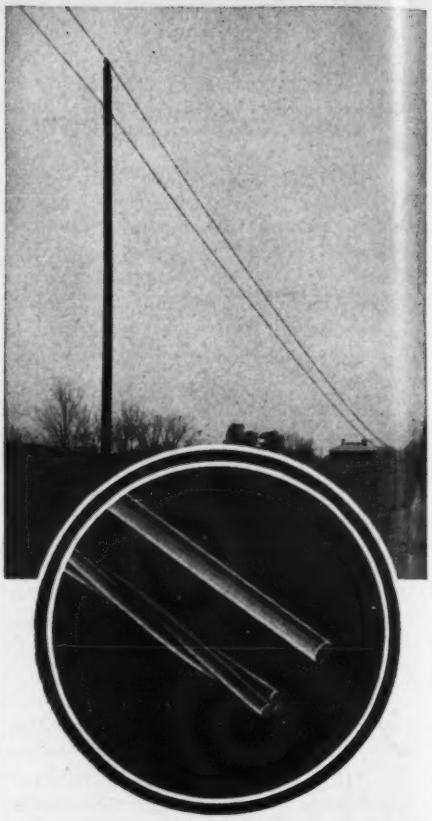
Present plans call for the installation of machinery and other necessary equipment in approximately one-half million sq. ft. of space as soon as the ordnance department completes removal of ammunition manufacturing equipment. The plant will employ approximately 1,500 persons and will confine its manufacture to long-line communications cable for the U. S. Signal Corps.

•

Opens New Boston Office

Electrical Apparatus Co., formerly at 1018 Commonwealth Avenue, Boston, Mass., is now located at their new office building at 1200 Soldiers Field Road, Boston. Among the features of the new offices are a completely equipped demonstration laboratory with instruments and other facilities, and an assembly hall for holding engineering meetings and showing moving pictures and slides of electrical installations, applications and manufacturing processes.

Crapo STEEL CONDUCTOR



Rural distribution lines of *Crapo* Steel Conductor will prove efficient, economical and dependable for years under normal operating conditions. The rugged tensile strength inherent in this conductor makes possible long-span, low-cost construction requiring a minimum of maintenance. Relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance contribute to improved electrical efficiency.

For rural extensions authorized by Utilities Order U-1-c, specify No. 6 B.W.G. *Crapo* HTC-130 Stranded (3-wire) Conductor—the size and type recommended for the purpose. For information on this or other applications, contact the nearest office of the Graybar Electric Co., Inc., Distributors, or write direct for Engineering Manual containing complete information on *Crapo* Steel Conductors.

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Field Reports on Business

Lighting equipment and individual motor sales feature the electrical market. An active demand also exists for switches, wire and wiring material. Official statements indicate that the manpower situation is still regarded as critical. The pronounced gain in retail trade over last year continues.

CHICAGO

Lighting equipment manufacturers here report they are currently swamped with orders on top priorities for industrial fixtures and fluorescent lamps for the military and lend-lease. With production facilities operating at full capacity shipments on priority orders are lagging behind schedules. It has been possible to fill only about half of the civilian allotment for the first quarter of this year but it is hoped that slack can be made up before April 1. Individual orders for 60,000 fluorescent lamps from the Army quartermaster corps, bearing the highest priority, are not uncommon, it is stated.

Similar conditions are reported by local switchgear manufacturers. Utility orders for high voltage apparatus are at a very low ebb. However lend-lease inquiries for switches are in good volume. No inquiries are yet appearing to indicate that post-war utility building plans are nearing completion, it was stated.

Since the revision of U-1 permitting distribution line extensions costing up to $1,500, orders for low-voltage distribution equipment have been coming from Wisconsin and Minnesota utilities in good volume, particularly since the first of February, observers in the Chicago area report. Suppliers report that they have all the business that they can handle between now and next October.

Activity of rural electric cooperatives is on the increase here.

Cardox Corporation, Chicago manufacturers of central storage CO_2 fire fighting equipment have recently received an order from the Army engineer corps in the amount of $18,000 for addition to "test cells" in Detroit, Mich.

NEW ENGLAND

New Haven Railroad has ordered, subject to WPB approval, 42 Diesel-electric locomotives, of which twenty 2,000-hp. and twelve 1,000-hp., are to be built by American Locomotive Co., with G.E. equipment and ten 44-ton switches to be manufactured by General Electric. The estimated cost is $4,830,000. A demand for electric lighting equipment for airports should be forthcoming. Vermont Transit Co., Rutland, has ordered 12 helicopters from American Car & Foundry, Philadelphia.

Plans are taking shape for a large television station in the Boston area sponsored by Westinghouse, forming part of an important eastern network. This confirms the prediction that post-war radio sales will be very active.

Small motor sales are spotty, but textile plants are buying steadily and will provide a fertile market for some time to come. Individual motor sales, especially of the induction type, are increasing, due to the accumulation of stock as a result of the diminishing demand from the machine tool industry and less restrictive control by the priority division of the government.

Great American Industries, Inc., Meriden, Conn., has been allocated $150,000 for equipment to be installed in a Vermont plant. The Navy has placed orders with A. F. Holden, New Haven, Conn., for salt bath type and forced convection furnaces for heat-treating, and Metropolitan Electric, Danvers, Mass., has been awarded an order for general purpose fuses. The Navy is active in buying wiring supplies for light and power aboard vessels under construction in local yards. Electric power sales in the four largest Connecticut utilities for February were the second largest of any month on record to date.

NEW YORK

Industrial production during the past week indicated a tendency to maintain the gains established in previous weeks. Continuing the rise which started in early March, business in the Pittsburgh district has reached the best levels since mid-February, the Bureau of Business Research, University of Pittsburgh, reports. Most of the rise resulted from a pronounced gain in trade, although small increases were reported in the volume of shipments and industrial production.

In the metropolitan district, retail trade continued active, but the average increase in department store volume did not measure up to the rise reported for the previous week. Bad weather was a factor.

Civil engineering construction volume in continental United States totaled $32,909,000 last week. This volume was 12 percent higher than in the preceding week, but 56 percent lower than the volume reported for the corresponding 1943 week by *Engineering News-Record*. Public construction was 18 percent above the preceding week as a result of the 23 percent gain in federal work; private work was 25 percent lower. Compared with the 1943 week, however, public was down 49 percent, and private construction was down 79 percent. The week's construction brought 1944 volume to $420,710,000 for the twelve weeks, a decrease of 50 percent from the $839,041,000 reported for the period in 1943.

PACIFIC COAST

Orders feature a $148,000 award for night lighting Army airfield in Montana. The electrical work for four Richmond schools; a sizable contract for panels, switches, wire and wiring material for new construction at Hunters Point, San Francisco; exceedingly heavy ordering of staple electrical items by Army Engineers San Francisco and Navy bids for large lots of such single items as 15,000 pairs of pliers and 25,000 receptacles.

Pacific Gas & Electric Co. has purchased $40,000 of carrier current equipment for northern California installation. Housing has again decreased though once again there is a surprisingly heavy aggregate of work principally private in the offing.

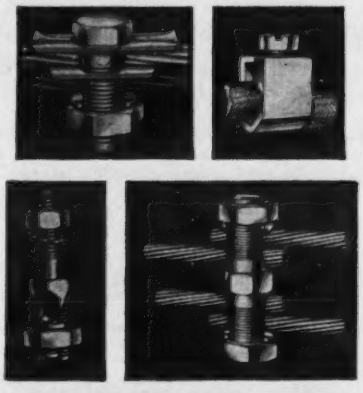
Mare Island expansions include a motor repair shop and other facilities aggregating $600,000. Occasional odd lots of small appliances are placed on the market and there has been some recent calling upon old accounts by manufacturers' representatives, but no expectations are felt of any early resumption of electrical merchandising business.

"All SIZES of SERVICE CONNECTORS—

from No. 10 to 1,000,000

and All TYPES"

You can find exactly the service connector you need, in the Penn-Union Catalog: Yoke-and-Nut type, in a complete range of sizes . . . Service Entrance connectors . . . Service Post and Special connectors in wide variety.

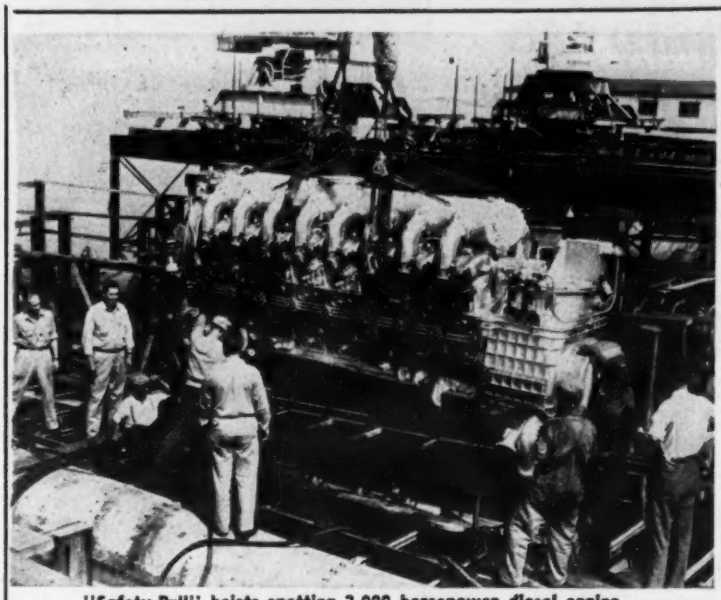


Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that "*Penn-Union*" *on a fitting is their best guarantee of Dependability*. Write for the Penn-Union Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings



"Safety-Pull" hoists spotting 2,000 horsepower diesel engine

The same **SIMPLE OPERATION**
in all sizes of "SAFETY-PULL"
RATCHET LEVER HOISTS

Side lever control for positive "up or down." A neutral position for safety control. Reversible handle permits the operating of hoist in any position. Safety stops prevent handle from spinning. Nine models from ¾ to 15 tons.

Write today for catalog EG6

COFFING HOIST COMPANY
DANVILLE ILLINOIS

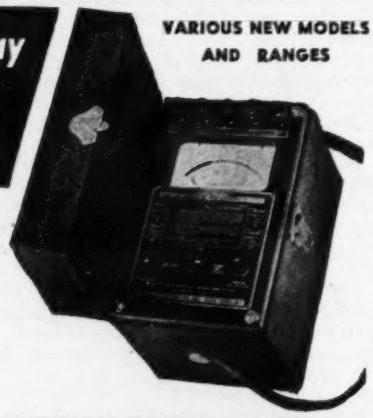
• Once upon a time, a utility executive said "Let's use OUTDOOR Meter Enclosures on INDOOR installations. The property owner will like the idea and we'll get a better price by standardizing on one item. OUTDOOR enclosures INDOORS mean fire-safe, dustproof meters. Tamper-proof, too. Why, it's an economy for us."

• Many utilities have found this economy in Outdoor Enclosure #7156 shown here. Our Bulletin #383 gives complete specifications and prices. Write us about meter and relay switches, devices, accessories, methods and enclosures.

METER DEVICES COMPANY • CANTON, OHIO

Test Insulation the Modern Way
with a MODEL B-5
MEGOHMER

VARIOUS NEW MODELS AND RANGES



NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430

Sales Opportunities

NEVADA—Federal Works Agency, Public Buildings Administration, Washington, D. C., will receive bids until April 14 for new Clark County Hospital, including electrical equipment and facilities, ventilating system, etc. Cost estimated about $500,000. M. L. Barker and G. Laurence Ott, 624 South La Brea Avenue, Los Angeles, Calif., are architects.

FLORIDA—United States Sugar Corp., Clewiston, plans new plant for manufacture of ethyl alcohol for government, comprising several one and multi-story processing and production buildings, with machinery and electrical equipment to develop initial capacity of 7,000,000 gal. per annum. Power plant used for sugar mill service will be increased in capacity, and group of miscellaneous structures erected for storage, distribution and other service. Plant is estimated to cost approximately $2,050,000. Project has been approved by Chemicals Bureau, WPB, and financing will be arranged through Defense Plant Corp. Proposed to begin work soon.

MONTANA—Bureau of Reclamation, Denver, Colo., will take bids soon for new electric-operated pumping station for irrigation system, including motor-driven pumping units, controls and auxiliary equipment.

NORTH CAROLINA — Virginia-Carolina Chemical Corp., Richmond Trust Bldg., Richmond, plans new plant for manufacture of sulfuric acid, to replace a works destroyed by fire a number of months ago, consisting of several one and multi-story buildings, with machinery and electrical equipment for rated output of about 70 tons per day. Cost reported over $600,000. Work will begin at early date. Project has a priority rating.

MASSACHUSETTS—Department of Mental Health, 100 Nashua Street, Boston, plans addition to power plant at institution as a post-war project, with installation of additional equipment for increased capacity. No estimate of cost announced. McClintock & Craig, Inc., 458 Bridge St., Springfield, is consulting engineer.

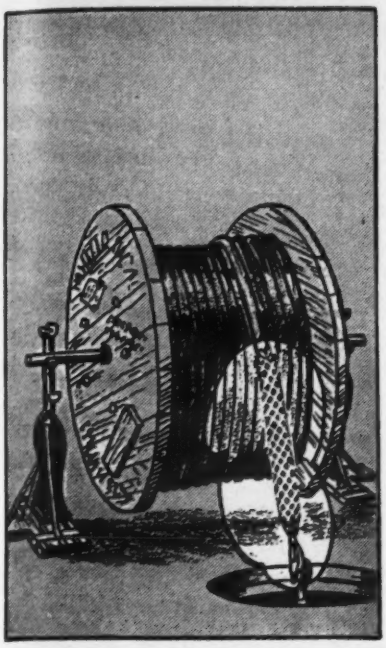
IOWA—Water Department, Clinton, plans new pumping station in connection with extensions in water system, with installation of motor-driven pumping unit and auxiliary equipment for rated capacity of 1,500,000 gal. per day. Project has been approved by State Department of Health and will be carried out soon. W. L. Meeker is manager of department.

CALIFORNIA—Navy Department, Washington, D. C., has authorized immediate expansion in Marine Corps air station, including warehouses, shops and other industrial buildings, with mechanical and electrical equipment. Also extensions in electrical distribution system and substation facilities. Project will include mess hall, school buildings, barracks and miscellaneous structures, and is estimated to cost $1,760,000. Kistner, Curtis & Wright, Spreckels Theater Bldg., San Diego, are architects. Project will be supervised by Public Works Office, Navy Department, 11th Naval District, foot of Broadway, San Diego.

MICHIGAN—Campbell, Wyant & Cannon Foundry Co., Muskegon, will make extensions in plant for production for government, including three new one-story buildings, with mechanical and electrical equipment. Cost estimated about $1,400,000. Financing by Defense Plant Corp. Work

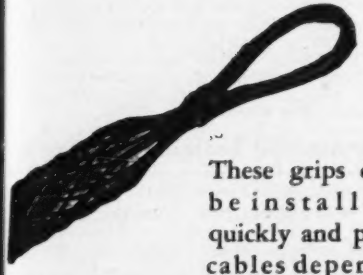
SPEED

CONSTRUCTION and EXPANSION of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles—all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

will begin soon. Chester J. Clark, 343 South Dearborn St., Chicago, Ill., is architect.

NEW JERSEY—War Department, Washington, D. C., plans expansion in Army air base, including hangar, shops, parachute building, warehouses and miscellaneous structures, with mechanical and electrical equipment. Cost estimated about $500,000. Work will begin soon and will be carried out under supervision of District Office of U. S. Corps of Engineers, Millville Airport. Wenner & Chase, 1500 Walnut St., Philadelphia, Pa., are architects.

WYOMING—Construction Service, Veterans' Administration, Washington, D. C., plans expansion in institution, comprising group of new one and multi-story buildings with mechanical and electrical equipment. Cost estimated about $1,500,000. Bids are scheduled to be asked early in June.

WEST VIRGINIA—West Virginia Coal & Coke Co., Inc., Atlas Bank Bldg., Cincinnati, Ohio, plans expansion in coal-mining plant and properties, including new tipple, shops and other buildings, including machinery and electrical equipment for increase in daily capacity from 4,000 to 10,000 tons. Cost reported in excess of $2,000,000. Project has a priority rating and will be placed under way at early date.

WISCONSIN—Water Department, Mauston, plans installation of motor-driven pumping machinery, with controls and auxiliary equipment in connection with extensions in water system. Bids will be asked soon. General Engineering Co., Portage, Wis., is consulting engineer.

OREGON—Bureau of Reclamation, Denver, Colo., will receive bids until April 19 for two motor-driven hoists for fish screen service in headworks of North Unit Main Canal, Deschutes project, exclusive of motor controls, but otherwise complete. Hoists will be installed by government (Specifications 1728-D).

NEBRASKA—Municipal Light and Water Department, Peru, plans extensions in primary and secondary lines to serve additional rural consumers. Permission has been granted by State Railway Commission and work will begin soon.

OKLAHOMA—Water Department, Oklahoma City, plans early construction of high and low pressure pumping stations, with motor-driven pumping machinery, controls and auxiliary equipment, in connection with new filter plant for water system, with rated capacity of 12,000,000 gal. daily. Entire project will cost about $796,000. A priority rating is being secured. C. F. Aurand is city manager.

UTAH—Department of Utilities, Provo, has report from Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., consulting engineer, recommending addition to municipal steam-electric generating station, with installation of two new turbine-generator units, two high-pressure boilers and auxiliary equipment. It is understood that project will be a post-war development.

•

Plans New Line

Arkansas Utilities Commission has granted the Arkansas Power & Light Co. permission to construct a 110-volt transmission line from Lake Village, Ark., to the company's sub-station near Pine Bluff, Ark., at an estimated cost of $660,000.

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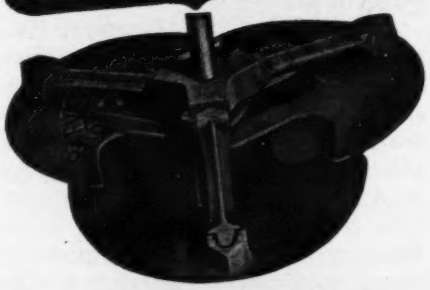

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Recent Rate Changes

California Electric Power Co., customers will receive benefits of a $100,000 annual reduction in electricity bills effective April 1. The California State Railroad Commission, acting unanimously, ordered the reduction after a hearing in Riverside. The decision stated the major portion of the reduction would be given to domestic users, but the highest rate of reduction would be assigned to street lighting service. Affected are scores of small cities and towns in the counties served, as well as several unincorporated areas.

Portland General Electric Co.'s petition for a rehearing of the case to enjoin Public Utilties Commission Flagg from enforcing his recent so-called emergency order directing the utility to reduce its rates by approximately 10 percent has been taken under advisement by Circuit Judge Duncan at Salem, Ore. This emergency order had previously been temporarily enjoined, attorneys of the company having contended that Commissioner Flagg's order was not justified under the Oregon statutes. Judge Duncan finally rendered an opinion that the order was valid and did not direct that the temporary order restraining it be made permanent. Hence this appeal for a rehearing.

Wisconsin Power & Light Co. has filed with the State Public Service Commission rate reductions which will save 82,000 residential electric customers approximately $230,000 a year.

Springfield (Mo.) Gas & Electric Co., has been ordered by the State Public Service Commission to reduce its electric rates by $304,000 a year.

Athol (Mass.) Gas & Electric has established rate reductions effective April 1 to save residential, commercial and industrial customers about $10,000 per year, the fourth such cut in 3.5 years. Discounts have been eliminated. Residential service will cost about $4,000 less per year. A former farm rate has been eliminated in favor of a new so-called "A" rate which will provide for equivalent prices under a farm service clause. Energy used for heating and cooking will be billed together.

Gardner (Mass.) Electric has announced a $10,000 rate cut as of April 1. About 6,400 residential customers will save $7,500 per year by the new schedule, those using between 20 and 50 kw.-hr. per month reaping the larger benefit. The new domestic rate starts at $1 for the first 12 kw.-hr. per month, with an 8-cent rate for the next 10 and a minimum of 3 cents per kilowatt-hour above 54 kw.-hr. per month.

•

Delay at Nisqually

Further postponement of the date when power will be generated at the Tacoma, Wash., second Nisqually project was occasioned by a sand pocket encountered in the 6,500 ft. tunnel being bored between the La Grande dam and its power house. Last October 15 was the time set when the new 40,0000 kw. generator at La Grande would start turning out energy. Expenditures to date on the project are $16,049,461.58.

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New Funds Allotted for Rural Projects

Announcement has recently been made of Rural Electrification Administration loan allotments totaling $899,500 to eighteen rural systems in six states. This brings total REA allotments to $481,273,551, of which $15,310,638 represents operations during the current fiscal year.

The greater part of these funds will be used to extend electric service to farms which can contribute substantially to the food production program. No construction will be undertaken which does not have the prior approval of the War Production Board.

Among the allotments are the following:

ARKANSAS—Carroll Electric Co-operative Corp., Berryville, $50,000; C & L Rural Electric Co-operative Corp., Star City, $75,000.

ILLINOIS—Clinton County Electric Co-op., Inc., Breese, $40,000.

IOWA—Humboldt County Rural Electric Co-operative, Humboldt, $6,500; Harrison County Rural Electric Co-op., Woodbine, $65,000; Maquoketa Valley Rural Electric Co-operative, Anamosa, $80,000; Greene County Rural Electric Co-operative, Jefferson, $50,000; Lyon Rural Electric Co-operative, Rock Rapids, $50,000; Hawkeye Tri-County Electric Co-op., Cresco, $60,000; Sac County Rural Electric Co-operative, Sac City, $45,000.

NEW MEXICO—Roosevelt County Electric Co-operative, Inc., Portales, $20,000.

OKLAHOMA—Oklahoma Electric Co-operative, Norman, $50,000; Red River Valley Rural Electric Assn., Marietta, $50,000; Choctaw Electric Co-operative, Inc., Hugo, $50,000.

TEXAS—Hill County Electric Co-operative, Inc., Itasca, $60,000; Victoria County Electric Co-operative Co., Victoria, $55,000; Stamford Electric Co-operative, Inc., Stamford, $75,000; Hill County Refrigeration Co-operative, Inc., Itasca, $18,000.

•

ASA Electric Group Puts Accent on War Work

The impact of the war was felt during the past year in the work of the American Standards Association committees on electrical projects, ASA recently reported, the most active committees being the five which have been working on war standards. These five committees reported 13 war standards completed and approved, and 12 others nearing completion. Committees working on regular standards reported that some of the standards already approved have been useful without change in the war effort, while others have been revised to meet emergency conditions.

Eleven regular American Standards recommended by the Electrical Standards Committee were approved by the Association during the year.

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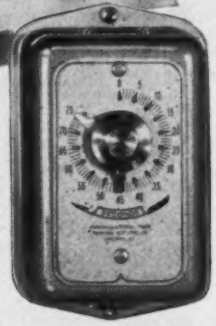

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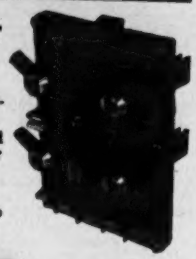

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LETTER TO THE EDITOR

Wood Pole Supply

To the Editor of ELECTRICAL WORLD:

For years it has been my practice to read the ELECTRICAL WORLD from cover to cover, together with *Business Week*. In fact, these are the only two publications that I spend very much time with in these strenuous days.

An editorial in the March 4 issue of ELECTRICAL WORLD entitled "Wood Tighter, Steel Easier" seemed to stress the shortages of forest products. This is generally true, but I would like to correct the impression that it may leave with our friends in the utility business that there is a shortage of long poles for construction of transmission lines, as was indicated in the last sentence of this editorial.

The January 31 stock sheet of the cedar pole industry carried over 45,000 Western Red cedar poles in lengths 50 to 75 ft. These are sizes commonly used in the construction of H-frame transmission lines for high voltages. This type of construction has become very popular during the past ten or twelve years. This quantity of poles would build at least 2,500 miles of high-tension line. These poles are all out of the woods and are in the concentration yards ready for treating and shipping. In addition to this, the industry is producing more of these longer lengths to supplement these stocks, and we do not anticipate any shortage of 50 ft. and longer poles for some time to come.

The pole shortages in the cedar pole industry are confined to the distribution and rural line sizes—that is, the 45-ft. down through the 25-ft. sizes. There is a serious shortage of these particular lengths and orders for these sizes would be subject to very much deferred shipments.

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•

Ross Dam Contract Let

A $1,795,000 contract for the construction of two 24½-ft. parallel tunnels around the base of Ross dam in City Light's Skagit River power development was awarded General-Shea-Morrison recently by the Board of Public Works in Seattle, Wash. Each tunnel will be 1,880 ft. long.

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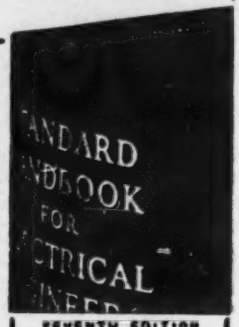

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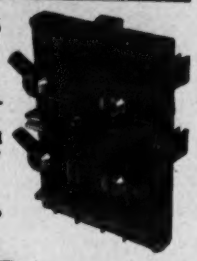

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LETTER TO THE EDITOR

Wood Pole Supply

To the Editor of ELECTRICAL WORLD:

For years it has been my practice to read the ELECTRICAL WORLD from cover to cover, together with *Business Week*. In fact, these are the only two publications that I spend very much time with in these strenuous days.

An editorial in the March 4 issue of ELECTRICAL WORLD entitled "Wood Tighter, Steel Easier" seemed to stress the shortages of forest products. This is generally true, but I would like to correct the impression that it may leave with our friends in the utility business that there is a shortage of long poles for construction of transmission lines, as was indicated in the last sentence of this editorial.

The January 31 stock sheet of the cedar pole industry carried over 45,000 Western Red cedar poles in lengths 50 to 75 ft. These are sizes commonly used in the construction of H-frame transmission lines for high voltages. This type of construction has become very popular during the past ten or twelve years. This quantity of poles would build at least 2,500 miles of high-tension line. These poles are all out of the woods and are in the concentration yards ready for treating and shipping. In addition to this, the industry is producing more of these longer lengths to supplement these stocks, and we do not anticipate any shortage of 50 ft. and longer poles for some time to come.

The pole shortages in the cedar pole industry are confined to the distribution and rural line sizes—that is, the 45-ft. down through the 25-ft. sizes. There is a serious shortage of these particular lengths and orders for these sizes would be subject to very much deferred shipments.

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•

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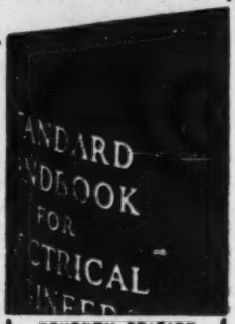

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1—6½ KW, 125 volt, General Electric, squirrel cage.

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1—400 HP, 514 RPM, 440 volt, Westg. slip ring.
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1—335 HP, 600 RPM, 2300 volt, B.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
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1—250 HP, 600 RPM, 2200 volts, G.E., slip ring
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
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1—500 HP, 900 RPM, 440 volt, Lincoln, sl. rg.
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1— 75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1— 75 HP, 720 RPM, 440 volt, Westghse, slip ring.
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1—200 HP, 440 volt, 600 RPM, Crocker-Wheeler, slip ring.

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2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM, Westinghouse, type SK.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

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3— 100 KVA, Westinghouse, 13200 250 volts.
3— 100 KVA, General Electric, 2200-220/110 volts.
3— 100 KVA, Allis-Chalmers, 2200/220/110.
3— 75 KVA, G.E., 13,500-7500/440 volts.
3— 75 KVA, G.E., 2200/220/110 volts.
1— 75 KVA, G.E., 2400/4800/120/240 volts.
1— 75 KVA, G.E., 3 phase, 4156Y-120/208Y.
3— 50 KVA, General Electric, 2200/220/110.
2— 50 KVA, Pbgh., 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440.
2— 30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1— 25 KVA, G.E., 220/110-220/110 volts.
2— 15 KVA, G.E., 2300-115/230 volts.

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1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electro Dynamic
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 30 HP, 225/900 RPM, Crocker Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1— 15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
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PROFESSIONAL SERVICES 130

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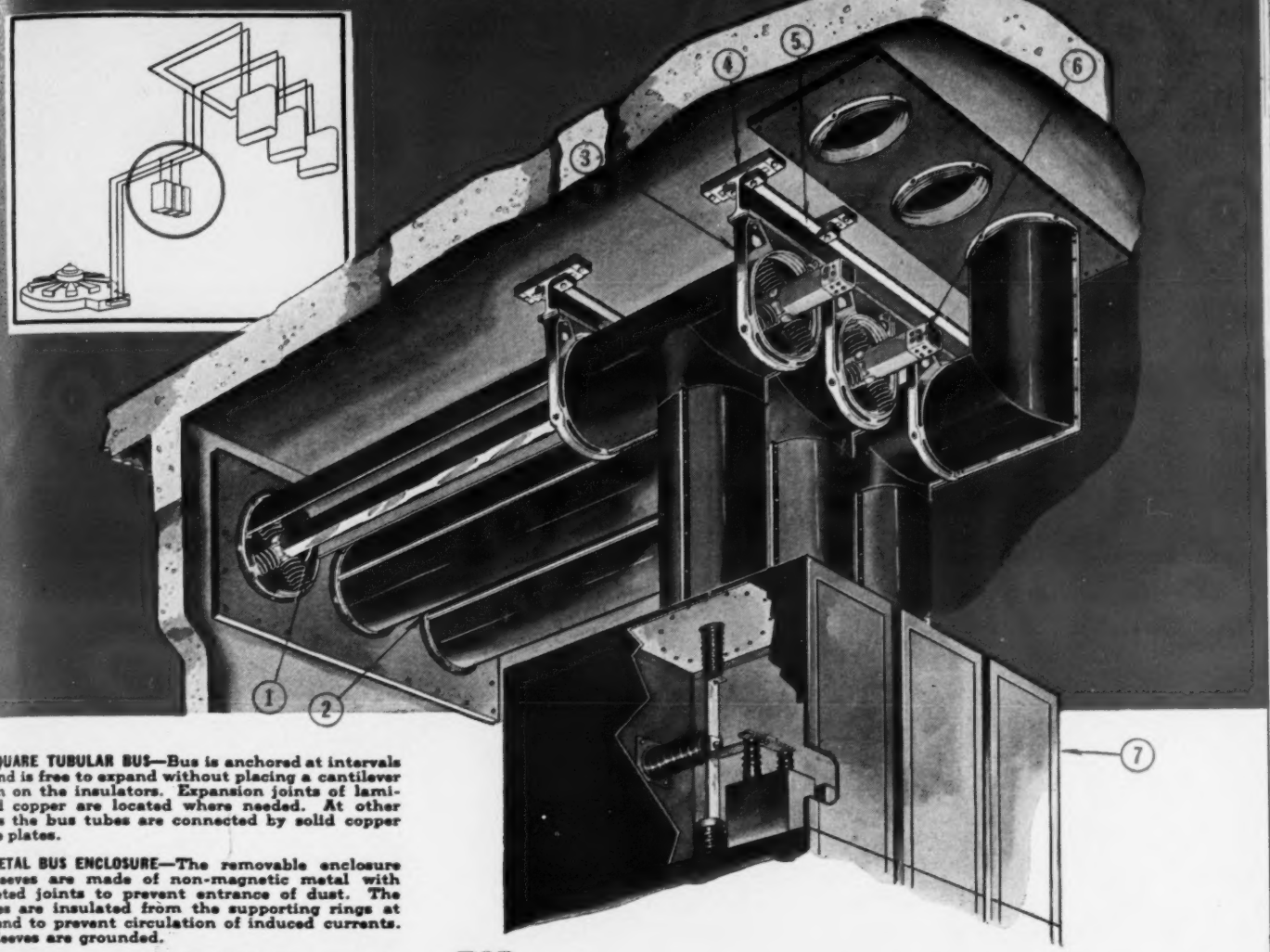
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

LAN NOW TO *Protect the Heart* OF YOUR SYSTEM

VITH I-T-E METAL-ENCLOSED BUS



1 SQUARE TUBULAR BUS—Bus is anchored at intervals and is free to expand without placing a cantilever strain on the insulators. Expansion joints of laminated copper are located where needed. At other joints the bus tubes are connected by solid copper splice plates.

2 METAL BUS ENCLOSURE—The removable enclosure sleeves are made of non-magnetic metal with gasketed joints to prevent entrance of dust. The sleeves are insulated from the supporting rings at one end to prevent circulation of induced currents. All sleeves are grounded.

3 SUPPORTING RING AND INSULATORS—The porcelain insulators are in compression and are free from cantilever strain because the bus can move longitudinally. Insulation is equal to that of connected apparatus. Each insulator is mounted in a ball and socket support to prevent any stresses except compression.

4 SUPPORTING BRACKET—These brackets have slotted bolt holes in serrated bearing pads to allow accurate alignment of the bus during erection. Mounting bolts are grouted in the masonry. Installation is easy because of the accessible design of the whole structure.

5 GROUND BUS—The ground bus is amply proportioned and bolted to the supporting brackets. The enclosing sleeves fit machined surfaces in the supporting rings when the sleeve clamping bolts are drawn up tight.

6 SILVER-SURFACED BUS JOINT—All bus joints are silver-surfaced to give low voltage drop and permanent freedom from overheating. At elbows like this the buses are joined with laminated copper expansion connectors.

7 POTENTIAL TRANSFORMER COMPARTMENT—The advantage of isolated-phase construction extends to these potential transformer compartments. Steel walls with dust-excluding gaskets give full protection. Short circuits cannot extend from phase to phase.

Whether conditions call for segregated-phase construction, as in the example illustrated, or a simple arrangement of conductors, electrical buses should be planned in the interest of life-long dependability and economy. With I-T-E such planning is an established business which starts with design and carries through complete assembly. I-T-E engineers have pioneered major improvements to provide structures that operate within specified temperature limits, are adequate electrically and mechanically and cause minimum voltage drop.

A detailed summary of the problems to be considered in planning is presented in a 24-page, illustrated booklet, "Electrical Buses and Bus Structures", written by William Deans, I-T-E Chief Engineer. It is Bulletin 4211, and a few copies are on hand.

A three-phase metal enclosed bus is shown because it is typical of thoroughly modern structures. The small diagram indicates position between generator and transformers.

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What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

1. What causes turbine oil deposits or sludge?

Petroleum oils are extremely complex mixtures of hydrocarbons. The basic cause of deposits or sludge in turbine oils is a "thirst" for oxygen on the part of certain of these hydrocarbons. When they oxidize they tend to form asphaltenes or acids or both.

The asphaltene-formers are the quickest to oxidize, with resultant deposit formation. Agitation of the oil under heat in the presence of oxygen and moisture—a natural condition found in turbines—is all that is needed to start trouble.

Oxidation is first indicated in conventional oils by darkening of the oil. Deposits may not become immediately apparent because of their solubility in hot oil. But as their concentration increases, they can no longer be held in solution. Eventually they settle in cooler parts of the turbine, such as oil coolers, and on pump screens, oil lines and filters. Deposits also occur at points of low oil velocity, such as in governors and bearing pedestals, and where centrifugal force operates as in couplings.

The most logical solution would seem to be to remove these asphaltene-formers—it can be done by refining. But it isn't that simple. The asphaltene-formers include natural oxidation inhibitors. Removal of these leaves the oil more susceptible to acidity formation, which causes poor demulsibility and other oil trouble, and may eventually lead to sludge formation.

Because of this, most turbine oils are a compromise. Some of the asphaltene-formers are left in the oil for their inhibiting effects—in spite of the certainty of asphaltene deposits. Acidity formation is slowed down by this, but turbines must be cleaned and the oil sweetened or treated periodically to reduce acidity.

Nonpareil is different. We take out *all* the asphaltene-formers—even though the natural inhibitors go out with them. Then we add an oxidation inhibitor which checks acidity formation even better than the natural ones. Thus, in Nonpareil, deposits from asphaltene-formers are completely eliminated. Causes of acidity and how it is controlled will be discussed in this space next month.

Oil is Ammunition . . . Use it Wisely

For all the answers send for this booklet...it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

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